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Final Report

Army Ordnance Contract DA-11-022-509-ORD-3070
ORD Project TB4-006D

Development of a Finishing System for Lightweight Metals

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April 17, 1963

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Section I

Introduction

The object of this contract was to develop finishing systems for lightweight metals in both clive drab and white colors. The ultimate use of these systems would be on aircraft, missiles and rockets, ground transportation equipment, and related items. The substrate of primary concern was to be Dow 17 treated HK-31 magnesium alloy. Aluminum and steel were to be given secondary consideration. It was understood that any new magnesium alloys developed during the term of the contract would also be used as substrates.

The major requirements of the system are:

- 1. Applicable by spray.
- 2. Air dry, preferably quick dry type.
- 3. Ability to withstand temperatures up to 500°F. for short periods of time without losing film integrity.
- Good film properties, such as hardness, toughness, adhesion, flexibility, durability, and corrosion resistance.
- Resistance to aviation gasoline, and, if feasible, diester lubricant.
- Good salt spray resistance, 2,000 hours alone, and
 500 hours bimetallic coupling.
- Quality control performed by general analytical and performance tests.

In addition, discussion with Army Ordnance Coating and
Chemical Department personnel prior to the start of work
on the contract brought out the following items:

- A two coat system, primer plus topcoat, was preferable to a one coat system.
- #2430 olive drab and untinted white were the desired colors for the topcoats. It was understood that the olive drab was of primary importance.
- 3. The gloss of the complete system was to be $15^{\circ}-25^{\circ}$ as measured at 60° .
- 4. The desired length of time for the coating to retain film integrity at 500°F. was 30 minutes minimum. If the coating could withstand 500°F. for 2 hours, this would be more desirable. The ability of the coating systems to withstand more than 500°F. was also to be evaluated.
- 5. The aviation gasoline to be used for test purposes was type III high aromatic content conforming to MIL-S-3136 while the diester lubricant was purified tricresyl phosphate as described in specification MIL-H-19457.

Section II

Initial Screening of Clear Films

Since a relatively high temperature was involved in this contract, it was believed a silicone was in order. These organic modified inorganic polymers are well known for their excellent heat resistance. The following silicones and silicone copolymers were chosen for initial screening:

- 1. General Electric SR-17
- 2. General Electric SR-28
- 3. General Electric SR-32
- 4. General Electric SR-82
- 5. General Electric SR-98 (now CR-116)
- 6. General Electric SR-111
- 7. General Electric SR-119
- 8. General Electric SR-120
- 9. Dow Corning DC-802
- 10. Dow Corning DC-803
- 11. Dow Corning DC-805
- 12. Dow Corning DC-806A
- 13. Dow Corning DC-840
- 14. Dow Corning XR-261
- 15. Dow Corning R-4471
- 16. Dow Corning R-6-0031
- 17. Dow Corning XR-856
- 18. Union Carbide R-64
- 19. Union Carbide R-630
- 20. Plaskon ST-847
- 21. Plaskon ST-856

It was realized that while silicones possess desirable high temperature properties, they are lacking in other respects such as ability to air dry and resistance to solvents.

Accordingly, it was decided to modify them with a variety of organic materials to form composite resins which would have most of the properties needed. Clear resin blends were made containing 90, 75, and 50% silicone resin solids (in a few cases, 25% silicone content materials were also evaluated) while the remainder of the vehicle nonvolatile matter consisted of the following organic resins:

- 1. 1/2 second RS nitrocellulose
- 2. 1/2 second SS nitrocellulose
- 3. 1/2 second cellulose acetate butyrate
- 4. Polyvinyl butyral Bakelite XYHL
- 5. Acrylic Rohm and Haas Acryloid A-101
- 6. Styrene butadiene Goodyeer Pliolite S-5
- 7. Triazine formaldehyde Rohm and Haas Uformite M-311
- 8. Polyvinyl formal Shawinigan Formvar 7/70
- 9. Modified alkyd Hercules Petrex SS
- 10. Epoxy ester Midland Industrial Finishes Company R-55
- 11. Oxidizing alkyd Midland Industrial Finishes Company R-9
- 12. Oxidizing alkyd Midland Industrial Finishes Company R-50
- 13. Phenolic Bakelite BRS-2600
- 14. Butadiene acrylonitrile Naugatuck Paracril CV
- 15. Fossil resin RBH 510

Since fluorinated hydrocarbon resins are also noted for their resistance to thermal degradation, some of these materials were modified in the same manner as the silicones. The following resins were used:

- 1. DuPont Viton A
- 2. Firestone Exon 461
- 3. Minnesota Mining and Manufacturing Fluorel
- 4. Minnesota Mining and Manufacturing Kel-F 800

The best finishing system for magnesium alloys prior to this contract was based on a polyamide cured epoxy. Consequently, the entire range of conventional bisphenol Appichlorhydrin resins was catalyzed with various curing agents. Two silicone epoxy copolymers, Dow Corning XR-6-0000, and Midland X-4209, were investigated at the same time. The curing agents used were:

- 1. Versamid 100
- 2. Versamid 115
- 3. Versamid 125
- 4. Versamid 140
- 5. Genamid 250
- 6. Genamid 310
- 7. Lancast A
- 8. Dow Corning Z-6020 and XZ-2-2023, amino functional silanes
- 9. Diethylene triamine
- 10. Shell curing agents H-1 and H-2

Other film formers which were screened include:

- 1. Midland R-62, a heat resistant non-oxidizing alkyd.
- 2. Spencer Kellogg XP-1078 high temperature polyurethane
- 3. Roskydol 500 polyester
- 4. Reichhold Polylite 8702 and 8703 polyesters
- 5. Rohm and Haas Paraplex P-444 polyester
- 6. Isocyanate cured Dow Corning R-6-0031
- 7. Silicones cured with experimental silazane #2311
- 8. Food, Machinery, and Commical Company's Oxiron resins cured with PMDA adduct
- Dow Chemical Company's epoxy novolac resins cured with PMDA adduct
- 10. Midland X-3928 silicone copolymer
- 11. Midland X-4415 silicone copolymer
- 12. Midland X-4323 silicone copolymer
- 13. Midland X-3934 urethane prepolymer
- 14. Archer Daniels Midland Aroflint 202-XA1-60 catalyzed resin
- 15. Shell Eponol H-55.1 B-40 linear thermoplastic epoxy.

It was decided to perform relatively simple tests on these resin systems to eliminate as many of them as possible and therefore, make the more detailed evaluation much smaller in scope. After samples were prepared, the coatings were applied to 30 gauge steel with a 0.003" Bird applicator. The coatings were allowed to air dry for 24 hours after which they were tested as follows:

- Air dry film properties such as dry, compatibility in the film, and adhesion were noted. See Table 1 for key to numbers used in rating film properties.
- 2. Panels were subjected to 500°F. for periods of 30 minutes and 2 hours. Any change in adhesion or loss of film integrity resulting from the heat exposure was noted. All coatings tested became dark in color after the heat test. See Table 1 for key to symbols used in rating heat resistance.
- 3. After allowing the coated panels to age for 96 nours, solvent resistance of the coatings was determined.

 Two small strips of each panel were cut, one strip being immersed for 4 hours in MIL-S-3136 fluid and the other being immersed for the same period in the lubricant. Any coating which softened was allowed to dry for 24 hours after which it was checked to see if it had regained its original hardness. See Table 1 for ratings used.
- 4. The wet samples of each coating were checked for storage stability after 1 month. Any gelation, stratification, or other ill effects were noted. See Table 1 for key to stability ratings.

Table 1

Key to Numerial Ratings and Symbols in Venicle Screening Tables

Rating	<u>Dry</u>	Adnesion
0	Hard	Excellent
1	Tack-free but slightly soft	Very good
2	Tack-free but soft	Good
3	Slightly Tacky	Fair
4	Tacky	Poor
5	Very Tacky	Extremely Poor

Compatibility

- C Compatible
- H Hazy
- I Incompatible

Stability 5

- C Compatible
- H Hazy
- S Stratified

Film Integrity

- 0.K. No perceptible change except for darkening.
- B Blistered
- N.G. Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Immersion

- U Unaffected
- S Softened
- D Dissolved

24 Hour Recovery

- Yes Recovered original properties
- No Did not recover original properties

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Section III

Results of Screening Clear Coatings

A. Half Second Nitrocellulose Modification of Silicone Resins

- 1. The compatibility of unmodified silicones and nitrocellulose was poor while the compatibility of some of
 the silicone copolymers and nitrocellulose was good.
 Since most unmodified silicones are supplied with
 aromatic hydrocarbon solvents, a few of the commercially available 100% NVM silicones were dissolved
 in methyl isobutyl ketone and blended with nitrocellulose. Compatibility was still poor.
- Compatibility and resistance to MIL-S-3136 fluid and diester lubricant were best at the 50% level of nitrocellulose.
- After the heat exposures, systems with borderline compatibility often displayed blistering.
- 4. For the most part, the RS and SS grades of nitrocellulose were equivalent in performance.
- For details of nitrocellulose modifications of silicone resins, see Tables 2 and 3.

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Table 2

Half Second RS Nitrocellulose Modification of Silicone Resins

	Lubricant 24 hr.							
	Lub 4 hr. Inmers	:) <u> </u>	=)	· · · =	
	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery		2 , , ,			1 1 2		
	MIL-S-3 4 hr. Inmers.	115	=		, i i i	ווע		5
one Resins	2 hr @500F Adh. Film Integrity	1 1 20) 1123	o 	0 . r		ווב	112
Silic		114	114	1 1 4	114	114	116	1 + 6
ation of	30 min @500F Adh. Film Integrity	וומ	1 1 123	0.K.	0.K.		, , a	1 1 22
todific	30 mi	110	1 1 8	115	114	1 1 70	114	1 1 4
Half Second RS Nitrocellulose Modification of Silicone Resins	Air Dried Film Dry Adhesion	114	118	114	114	, , ,	114	114
Nitro			110	0	0		110	110
Second RS	30 day Stability	ιιω	ιιω	ιιω	נטוו	ו ו ט	1 1 03	1 1 03
Half	Film	1 1 0	110	110	110	, , 0	110	110
	Compatibility Solution Film	ння		ння	ннж	ннж	ння	ннн
	62 1	90 75 50	90 75 50	90 75 50	90 75 50	90 75 50	90 75 50	90 75 50
	Silicone	SR-28	XR-261	SR-111	SR-17	ST-847	DC-802	DC-803
	Vehicle Code	301-1-C	301-1-E	301-2-A	301-2-E	301-2-G	301-2-K	301-2-м

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Table 2 (continued)

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							20777777	TOOTTOO	וכשרומנו מו	21110	Silicone Kesins				
Vehicle Code	Silicone	H	Compatibility Solution Film		30 day Stability	Air Dry	Air Dried Film Dry Adhesion	30 mir	30 min @500F.	2 hr.	@500F.	MIL-S3136 Fluid	6 Fluid	Lubr	Lubricant
						1			Integrity		Integrity	Immers.	Recovery	4 hr. Immers.	24 .ir. Recovery
301-3-A	DC-806A	90	1		•	ı	•		•	,	(
		75	-	•		•		•	•	1 1	1	ı			•
		20	Ŧ	ပ	တ	-	4	7	2 21	4	• м	. 5		. =	
301-3-C	R-6-0031	90	ပ	ပ	U	0	7	~	<u>></u>	·	÷	c	1	•	ı
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		20	ပ	ပ	ပ	0	-	ı m	0.K	n m	0 X	o D	Q ,	b	
301-3-E	SR-119	90	н		1	,	ı	(1)	
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301-3-G	ST-856	8	1	1	1		•	•	•	1	ı				
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301-3-K	XR-856	8	¥	H	S	,	•		•	,	,	1			
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		20	Ŧ	ပ	Œ	0	2	e	0.K.	4	0.K		' '	. =	•
301-3-M	DC-805	90	H	•	•		(•	•
		75	H					,	•		ı			1	•
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301-4-A	SR-32	90	H		•		•	•				(
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Table 2 (continued)

Half Second RS Nitrocellulose Modification of Silicone Resins

			2	Hall Second	sond RS Nit	rocell	talose Modi	fication	RS Nitrocellulose Modification of Silicone Resins	one Re	sins				
Vehicle Code	Silicone	14	Compatibility Solution Film		30 day Stability	Air D Dry	Air Dried Film Dry Adhesion	30 min	30 min @500F. Adh. Film Integrity	2 nr.	2 hr. @500F. Adh. Film Integrity	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubricant 4 hr. 24 Imm.ers. Reco	cant 24 hr. Recovery
301-4-C	301-4-c xR-630	828	H # #	. 11 0	ı w w		114	114	ıι¤	114	ιıα	115	111	115	
301-4-E	SR-82	90 75 50	нн≖		110	0	1 1 4	1 1 4	ιıα	1 1 6	1 1 11	1 1 0	1 12	1 15	
301-4-G	DC-840	90 25 50	ння	, , 0	1 1 03	0	ıım	114	IIΩ	ιιm	IΙΩ		1 1 1	1 I D	
301-4-M	SR-120	90 75 50	нтя	100	ı w w	.00	1 20 4	- 4 5	ı ea ea	15050	. យ យ	. s n	ON I	. sp	NO I
301-2-C	SR-98	90 75 50	H H E		1 1 50				1 1 1	1 1 1		1 1 1		1 1 1	
301-5-E R-4471	R-4471	90 75 50	H E E		• w w	0	ווא	ıım	0.K	1 1 m	 0.K.	n			

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	<pre>C - Compatible H - Hazy S - Stratified</pre>
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky	ility	Compatible Hazy Incompatible
Rating	0	-	7	æ	4	5	Compatibility	C - Compatible H - Hazy I - Incompatib

Film Integrity

0.K. - No perceptible change except for darkening. B - Blistered

N.C. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - UnaffectedS - SoftenedD - Dissolved

Yes - Recovered original properties

24 Hour Recovery

No - Did not recover original properties

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Table 3

	Lubricant 4 hr. 24 hr. Immers. Recovery		1 1 1			1 1 1		
	Lul 4 hr. Immer		1 + 5		•••	1 12	1 1 0	115
	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery					, , Q		1 1 1
	MIL-S-3 4 hr. Immers.	111			ıın	ιιω	115	n
Half Second SS Nitrocellulose Modification of Silicone Resins	Film Film Integrity	111	1 1 22	• • <u>m</u>	ıι¤	ıια	1 1 22	1 1 22
f 51116	2 hr. Adh.	1 1 1	ווה	1 14	1 1 2	1150	1 1 4	ıιm
fication o	30 min @500F. Adh. Film Integrity		ΙIΩ	וובם	וומ	1 1 22	ıια	ııρ
e Modi	30 mi		118	1 14	5	1 ; 57	1 I M	114
trocellulos	Air Dried Film Dry Adhesion		1 I M	1 1 4	וומ	114	1 1 55	114
SS NI			0	0	1.1 =4	0	1 10	0
alf Second	30 day Stability	1 1 03	1 1 00	1 1 53	נטוו	1 1 53	1 1 03	1 I W
≖I	Film		110	110	נוט	י י ט	1 1 0	, , ט
	Compatibility Solution Film	ннщ	H H #	ння	ннш	ння	ннж	ннж
	14	90 25 50	90 75 50	90 75 50	90 75 50	90 75 50	90 75 50	90 75 50
	Silicone	SR-28	XR-261	SR-111	SR-17	ST-847	DC-802	DC-803
	Vehicle Code	301-1-D	301-1-F	301-2-8	301-2-F	301-2-н	301-2-L	301-2-N

Table 3 (continued)

Half Second SS Nitrocellulose Modification of Silicone Resins

			•1			TOTAL TOTAL	TTDOT 2	tcarton of	31116	ittiocettatose indilication of billcone Resins				
Vehicle Code	Silicone	ᆈ	Compatibility Solution Film	30 day Stability	Air D Dry	Air Dried Film Dry Adnesion	30 min Adh.	30 min @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recover	36 Fluid 24 hr. Recovery	Lubr. 4 hr. Inmers.	Lubricant r. 24 hr.
301-3-B	DC-806A	8 2 2 3 3	нин	ιιω	0	1 1 4	114	ıım	וומ	ıι¤	• • •	111	5	
301-3-D	R-6-0031 90 75 50	1 90 75 50	0 0 0	ပ ပ ပ	000	m 4 4	ოოო	0.K. 0.K.	446	0 0 0 K	s s D	ON ON	ממט	2 , ,
301-3-F	SR-119	90 75 80	H H	ι ι თ		1 1 LA	114	 0.K.	114	- 0.K.	ιια	ııÖ	נטוו	, , <u>Q</u>
301-3-н	ST-856	90 75 50	1 H O	ιαυ		144	144	0.K.	1 m 4	0.K.	ı s n	YES	ממו	
301-3-L	XR-856	90 75 50	HHH	ı w w		1 1 5	114	0.K.	114	0.K.				4 1 1
301-3-N	DC-805	90 75 50	HHH	1 1 03		114	114	1 1 22	114	1 1 🛱	5			
301-4-B	SR-32	90 75 50	EHH	1 I W	0	114	115	ıιæ	114	1 1 11	5		115	

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Table 3 (continued)

Half Second SS Nitrocellulose Modification of Silicone Resins

				-,	מפרטוות	25	CTOCETTOTO	DOL TOU	MALE SECURE SO NICIOCETULOSE MULTICACION OL SILICONE MESTIN	7770 7	COUR MESTU	••			
Vehicle Code	Silicone	14	Compatibility Solution Film		30 day Stability	Air D	Air Dried Film Dry Adhesion	30 mt	a 30 min @500F.	2 hr.	Adh. Film	MIL-S-31 4 hr.	MIL-S-3136 Fluid 4 hr. 24 hr.	Lubr.	Lubricant 4 hr. 24 hr.
301-4-D	301-4-D XR-630	90	н	•	1	•	ı		-		-				- 7
		25	 =	, 0	ı v	, c	- 7	. 7	1 12	١ ٧	ı p	. =		. =	
•	(3	: ,	•	2	>	•	٠	•	•	•	•	ı	•	1
301-4-F	SK-82	35	⊣ ⊢												
		20	æ	ပ	S	0	4	ო	æΩ	33	щ	S	NO NO	n	•
301-4-Н	DC-840	90	H	•	•	•	•	•	•	•	1		•	•	1
		75 50	1 H	ני	ιთ	. 0	14	ıπ	ıα	ıε	ıæ	ιω	ON	'n	
301-4-N	SR-120	90	1	•	•	•	1	ı	•	•	ı	,	•		ı
		75	H	•	•	ı	•						•	1	•
		20	ı	•		ı	•	ı		•	,		•	•	•

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Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	<pre>C - Compatible H - Hazy S - Stratified</pre>
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky		 1e
Rating	0	1	7	m	7	Ŋ	Compatibility	C - Compatible H - Hazy I - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

Yes - Recovered original properties No - Did not recover original properties

B. Half Second Cellulose Acetate Butyrate Modification of Silicone Resins

- The compatibility of silicones and half second cellulose acetate butyrate was better than the nitrocellulose modified silicones but was still quite poor.
- Again, compatibility and resistance to the test fluids were best at the 50% level of modifier.
- 3. Coatings which were subjected to the 500°F. heat test performed quite well in general.
- 4. For details of cellulose acetate butyrate modifications of silicone resins, see Table 4.

C. Acryloid A-101 Modification of Silicone Resins

- The compatibility of silicones and Acryloid A-101 was quite good.
- Resistance to the test fluids was poor with many of the coatings being completely soluble in the fluids.
- The Acryloid A-101 modified silicone coatings withstood 500°F. very well.
- 4. For details of Acryloid A-101 modifications of silicone resins, see Table 5.

Table 4

Half Second Cellulose Acetate Butyrate Modification of Silicone Book

	771	Recovery	, §	2 2	•	<u>Q</u> 2			•	ı	٠,		ı	ì	ı			ı	1	
	4	Impera	, 0	ာတ		တ တ			n	•	•	Þ	·	. ;	5	1	٠:	5		םי
	MIL-S-3136 Fluid 4 hr. 24 hr.	Kecovery	, 8	YES	. !	2 2	1	'	ON N	•	•	8	•	. 2	2	•	044	163	•	NO
esins			ıø	S	1 0	n vs	•		n	•	. (so.	•	. 0)	•	. 0	•		ιø
ilicone R	G500F. Film	711795117	0.K.	0.K.) C	0.K		١ ٥	•		•			0.K			0.K.	<u>:</u>		0.K.
n of S	2 hr. Adh.	•	ı m	7	ım	m		1 6	,			ı		1 4			- 2			ε E
main Second Celiulose Acetate Butyrate Modification of Silicone Resins	30 min @ 500F. Adh. Film Integrity		0.K	0.K.	0.K.	0.K	•	0.K						0.K.			0.K.			0.K.
yrate	30 mfr		140	า	. m	e		ım						4		• 1	ı εη	ı		e
cetate Bu	Dried Film Adhesion		1 40	,	ıπ	7		- 2			- 4		٠ 4	4			3	•		e.
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בכסעם כפודו	30 day Stability	•	øυ	, ,	ı va ı	ပ	1	ıω	•	ı ı	S		တ	H	•		S	•	•	S
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,	Compatibility Solution Film	H	ပပ	-	# (, ,	-	: #	H	н	Ħ	н	= :	=	H	ı	×	H	= :	z
		8	22 20 20	8	25 05	3	3 %	200	8	7.5	20	8	55	2	90	75	20	90	75	2
	Silicone 7	SR-28		XR-261		5	111_uc		SR-98			SR-17			ST-847			DC-802		
Vehfole	Code	301-14-B SR-28		301-14-C XR-261		301-14-p cm-111	707-11-		301-14-E			301-14-F			301-14-C ST-847			301-14-H DC-802		

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Table 4 (continued)

Half Second Cellulose Acetate Butyrate Modification of Silicone Resins

Vehicle Code	Silicone	ы	Compatibility Solution Film	ty 30 day	ži.	Air Dried Film Dry Adhesion		30 min @500F. Adh. Film Integrity	Adh.	Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recover	36 Fluid 24 hr. Recovery	Lubricant 4 hr. 24 h	24 hr. Recovery
301-14-K DC-803	DC-803	90 20 50 50	H II I	. S S	1 10	ıım	ווה	 0.K.	ıım	 0.K.	1 1 53	- YES		
301-14-L	301-14-L DC-806A	90 75 50	H # #	I S S	110	ווה	- 1 7	- 0.K.	ıım	 0 . K.	ιιν	, , ON	n	
301-15-A	301-15-A R-6-0031 90 75 800 800 800 800 800 800 800 800 800 80	. 90 75 50	OIE	C C R	0 0	ന ന ന	121	0.K.	3 2 2	0 0 0 .K.	000	1 1 1	o o o	TES
301-15-B	SR-119	90 75 50	= = =	S S C C C	100	188	188	0.K.	146	0.K.	ı w w	NO YES	ı w w	. 0.0
301-15-C	ST-856	90 25 50	нжж	C H L	100	ı ın ın	188	0.K.	100	0.K.	100			
301-15-D XR-856	XR-856	90 75 50	ння	0 K I	110	1 14	ıım	0. K	ιιm	0 . K	1 1 5	- YES	115	
301-15-E DC-805	DC-805	90 75 50	нжж	. s s	110	118	114	0.K.	1 I M	0.K.	ι ι ω	- YES		

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Table 4 (continued)

Half Second Cellulose Acetate Buty

;				main Second Cellulose Acetate Butyrate Modification of Silicone Resina	Turose	Acetate B	utyrate	Modificat	tion of	Silicone F	lesins			
Venicle	Silicone	и	Compatibility Solution Film	30 day Stability	Air D	Air Dried Film Dry Adhesion	30 min	30 min @500F. Adh. Film	2 hr.	2 hr. @500F. Adh. Film	MIL-S-3136 Fluid 4 hr. 24 hr	Fluid 4 hr	Lubricant	ant 37
301-15-F SR-32	SR-32	8	. 1	,		i	•	Integrity		Integrity	Inmers. R	Recovery	Immers.	Recovery
		75 50	нн	တ တ	. 0	1 1 4	1 1 11	1 1 0	1 10	1 1 0				
301-15-G XR-630	XR-630	90		1 (,	ı		,	، د	• •	'n	ON ON	n	•
301-15-0		205	. E	n vs	١٥	۱۳	١ 4	ıα	۱۳	- 0.K.	י ו א	02	=	
H-CT-TOC	2K-82	90 20 20	100	100	100	- 1 - 2	1 2 5	в 0.К.	126	. O . K	ı oo u	NO.	o , o	, 1 0 <u>8</u>
301-15-K	DC-840	90 75 50	H 0 0	100	100	128	ınn	B B C K	144	0.0.K	י מו מ	YES NO	ν i ν	ON 1 ON
301-15-L	R-64	90 75 50	000	ပပပ	000	3 2 2	4 N W	0.K.		00 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	w Dw	YES NO	თ თთ	ON ON
301-15-M SR-120	SR-120	90 75 50	000	ပပပ	0 0 0	ന്നവ	l m m	0.K.) ເພພ	0.K.	ν ινν	YES YES YES	ν ινν	ON I ON

Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
- 4	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
3	Slightly tacky	Fair
7	Tacky	Poor
ر.	Very tacky	Extremely Poor
Compatibility		Stability
C - CompatibleH - HazyI - Incompatible		<pre>C - Compatible H - Hazy S - Stratified</pre>

Film Integrity

O.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery	
Gasoline and Lubricant Resistance	

U - Unaffected
S - Softened
D - Dissolved

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Table 5

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Acrylic (Acryloid A-101) Modification of Silicone Resins

Vehicle Code	Silicone	14	Compatibility Solution Film		30 day Stability	Air	Air Dried Film Dry Adhesion	30 mir	30 min @500F. Adh. Film Integrity	Adh.	G500F. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubr 4 hr. Immers.	Lubricant r. 24 hr. ers. Recovery
301-22-A	SR-28	90 75 50	ပပပ	ပပပ	ပပပ	400	ν v 4	1 4 6	0.K.	146	0.K.	ı Q S	ı ON	· a Þ	
301-22-B	XR-261	90 75 50	ပပပ	ပပပ	ပပပ	0 11	588	642	0.K. 0.K.	444	0.6 0.8	999	1 1 1	QQS	, , <u>0</u>
301-22-C	SR-111	90 75 50	рни	H	ט ו ו	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1			1 1 1) I (
301-22-D	SR-98	90 75 50	ннн	1 1 1	1 1 1	1 1		1 1 1	f f f	1 1 t		1 1 1	1 4 4	1 1 1	i 1 1
301-22-E	. SR-17	90 75 50	# # #	H . O	מומ		1 1 4	1 1 4	- 0.K.	114	0.K.	ווא	, i ON	1 1 8	NO NO
301-22-F	. SI-847	90 75 50	# H #	010	SIS	0 1 0	4 4	4 4	0.K.	7 - 7	0.K. 0.K.	Q - Q	1 1 1	လ + လ	ON ON
301-22-G	301-22-G DC-802	90 25 50	ння	1 1 0	ι ι ω	1 10	1 1 4	1 14	0 .K.	1 1 6	 0.K.	, , ,		ı ı w	, , 02

Table 5 (continued)

Acrylic (Acryloid A-101) Modification of Silicone Resins

Vehicle			Compatibility	30 day	Air D	Air Dried Film	30 min	30 min @500F.	2 hr.	2 hr. @500F.	MIL-S-3136 Flusd	6 Flutd	Lubricant	, de
Code	Silicone	11	Solution Film	Stability	Dr.y	Adhesion	Adh.	Film Integrity	Adh.	Film Integrity	4 hr. 2 Immers. R	24 hr. Recovery	4 hr.	24 hr.
301-22-H DC-803	DC-803	90 75 50	ж ж ж ж ж ж	w i w	010	רו ו	4 1 6	0.K. 0.K.	m 1 m	0.K.	ΩιS	, , <u>0</u>	a . «	, , Q
301-22-K	301-22-K DC-806A	90 75 50	### ###	တ တ တ	000	6 4 8	4 ጥ ጥ	0.K. 0.K. 0.K.	5 5 3 3	0.K. 0.K.	QQS	, , <u>0</u>	995	
301-22-L	301-22-L R-6-0031	. 90 75 50	O O O H	OOH	000	584	644	0.K. 0.K. 0.K.	5 2 3	0.K. 0.K.	000		995	
301-23-A	SR-119	90 75 50	000	ပပပ	000	សសស	n n 2	0.K. 0.K.	7 7 7	0 0 0 . K.	000	1 1 1	O O S	, , <u>8</u>
301-23-B ST-856	ST-856	90 75 50	O O O	ပေလလ	000	0 7 0	464	0.0 0.K	ოოო	0.K.	000		O O S	ı ı Q
301-23-C XR-856	XR- 856	90 75 50	I I H	1 1 00	1 1 0	ווה		0.K.	2	 0.K.	, , ,		1 1 00	, , OX
301-23-D DC-805	DC-805	90 75 50	т н н	ı w w	110	1 1 1/0	1 1 11	 0.K.	1 1 11 11	0.K.	iια	, , Q	n	

Table 5 (continued)

Acrylic (Acryloid A-101) Modification of Silicone Resins

Silicone	re	Compatibility Solution Film		30 day Stability	Air D Dry	Air Dried Film Dry Adhesion	30 min Adh.	30 min @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lub 4 hr. Immers.	Lubricant r. 24 hr. ers. Recovery
SR-32	90 75 50	ння	110	, , 03	ı 1 -	4	ווה	0.K.	114	0.K.	1 1 03) I N	ווא	, , ON
301-23-F XR-630	90 75 50	重型器	оно	တ ဟ တ	010	3 - 4	∢1 I W	0.K. 0.K.	en 1 en	0.K. 0.K.	QIS	- YES	0 1 5	
SR-82	90 75 50	ပပပ	ပပပ	ပ ပပ	000	354	n 4 n	0.K. 0.K.	7 7 7	0.K.	QQS	ı ı ON	a a b	1 1 1
301-23-н рс-840	90 75 50	ပပပ	ပပပ	ပပပ	000	888	9 7 3	0.K.	440	0.K.	999	111	0 0 S	ı ı Z
301-23-L SR-120	90 75 50	ပပပ	ပပပ	ပပပ	2 0	N N 4	. m m	0.K.	t 7 1	0 0.K.	, 00		• a s	1 1 X
301-23-K R-64	90 75 50	υυυ	ပပပ	ပပပ	000	w 4 10	m 4 4	0.00 X.X.	m 4 4	0.K 0.K	Own	ON	o o o	ı ı X
301-23-M R-4471	90 75 50	= = =	ннж	တ လ လ	0	: 1 =	1 1 -4	ıιρ		ııα	ιισ	ııQ	115	

Key to Numerical Ratings and Symbols

Adhesion Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	C - Compatible H - Hazy S - Stratified
<u>Dry</u> Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky		
Rating 0	r.	2	3	7	57	Compatibility	C - Compatible H - Hazy I - Incompatible

Film Integrity

0.K. - No perceptible cnange except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery	
Gasoline and Lubricant Resistance	

U - Unaffected
S - Softened
D - Dissolved

D. Polyvinyl Butyral Modification of Silicone Resins

- The compatibility of Bakelite XYHL and silicone resins was very poor.
- Resistance to MIL-S-3136 fluid and diester lubricant was extremely poor.
- 3. The film integrity of these coatings was good after the 500°F . heat exposure.
- 4. For details of Bakelite XYHL modifications of silicone resins, see Table 6.

E. Styrene Butadiene Modification of Silicone Resins

- The compatibility of Pliolite S-5 and silicone resins was excellent.
- These coatings did not air dry as well as most of the other systems which were evaluated.
- Almost all the coatings were completely soluble in the test fluids.
- 4. Film properties after the heat exposure were good.
- 5. For details of Pliolite S-5 modifications of silicone resins, see Table 7.

- 29 -

Polyvinyl Butyral (Bakelite XYHL) Modification of Sili

Table 6

Vehicle			Compatt	-	2013 July 1 Duryral (bakelite XYHL) Modification of Silicone Resins	ULYEAL	Бакелте	XXHL)	Modificat	ion of	Silicone R	esins			
Code	Silicone	21	Solution Film	n Film	Stability	Air D	Air Dried Film Dry Adhesion	30 min	30 min @500F. Adh. Film Integrity	2 hr. Adh.	G500F. Film Integrity	MIL-S-3 4 hr.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers Reconstruct	Lubr 4 hr.	771
301-10-B	SR-28	8	H	•	,	,	ı			•			V Tanconer V	mers.	Kecovery
		75	Ŧ	1	v.	·	, ,					,	•	1	1
		20	H	: O	လ	۲ ۲	n 0	m m	0 O	7 %	0.K	S) (O)	ON	S	ON
301-10-C xR-261	XR-261	6	-)	•	1	0.K.	'n	ON O	S	NO
	: :	2 :	- :	•		•	•	,	,	1					
		2 (H	ပ	တ	7	ო	2	2	, ,	; ; (•	•
		20	=	ပ	S	0	2	ı m	, N	٦ ٣	V. K.	s c	YES	S	NO NO
100	;									י		'n	<u>Q</u>	တ	2
301-10-D SK-III	SK-111	8	H	•		•	,								:
		75	Ή	н	S.	,	I	,	,	ı	•			•	1
		20	Ξ	ر	, 0				•	•	,	•	,		1
			:	,	מ	>	4	4	0.K.	7	0.K.	v.	Ç.		. ;
301-10-E	SR-98	90	_	1)	2	n	2
		75	. :		, (ı	•			,					
		2 6	c :	-	S	,	•	,	•	1	ļ			•	
		2	Ξ.	ပ	တ	0	ო	7	X	٠ ،	:				
301-10-E SP-17	CD-17	ć	,						•	4	o.k.	w	NO	S	YES
3-01-100	/T-VC	2	- 4	•		,		,							
		75	н	н	S		,	r	•	,	•		•	,	
		20	X	ပ	S	2	. ~		1 (•	,	
					,	,	1	4	o, K	4	0.K.	S	Q.	V.	QN
301-10-G	ST-847	8	1	,	,	,)	2
		75	H	Ι	v:		•	•			•	1	•	,	1
		20	=	1) (,	•	•	•	•		1
		,	:	=	0	>	7	7	0.K.	~	2	c	. :		•
301-10-H DC-802	DC-802	6	=	1	۵				•	1		o	ON.	S	NO NO
	1	75	: ::	4 5	n (•	,		,	•	,			
		2 5	c ;	E :	'n		5	7	X	,	.		• }		•
		20	Ŧ.	I	S	_	7	٠, ٠	4.0	o c	. Y.	י מי	NO N	s	NO NO
								1		า	0.K.	w	ON	S	NO

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Table 6 (continued)

Polyvinyl Butyral (Bakelite XYHL) Modification of Silicone Resins

			4 1	ישיוול דווול הרבל	101	WETTER VIII	7	0 107787	7777	ITESU DIO	ni			
Vehicle Code	Silicone	14	Compatibility Solution Film	ty 30 day	Air I	Air Dried Film Dry Adhesion	30 mir	30 min @ 500F. Adh. Film Integrity	2 hr. Adh.	2 hr. @500F. Adh. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubr 4 hr. Immers.	Lubricant hr. 24 hr. mers. Recovery
301-10-K DC-803	DC-803	95 50 50	***	T S S H	100	1 60 61	1 4 4	0.K.	ı m m	- 0.K. 0.K.	ιωთ	NO ON	· w w	NO YES
301-10-L DC-806A	DC-806A	90 75 50	## #	H S S S	.00	ı m m	146	0.K.	ı m m	0.K.	· w w	- 0N ON ON	ממי	
301-11-A	301-11-A R-6-0031 90 75 50	1 90 75 50	няя	, w w	. 0 0	1 6 8	13.	0.K.	1 6 6	0.K. 0.K.	ı w w	ON ON	ıası	, , QN
301-11-B	SR-119	90 75 50	###	H S S	1 7 0	1 20 4	ımm	0.K	ı m m	0.K.	100		ıas	, ON
301-11-C	ST-856	90 75 50	нжж	1 W W	100	1 24 2	3 7	0.K.	ınn	0.K.	1 8 8		ı w w	NO ON
301-11-D	XR- 856	90 75 50	нжж	. S S	110	ıım	3	 0.K.	1 I M	0.K.	ıισ	1 1 Z	115	
301-11-E DC-805	DC-805	90 75 50	E E E	I S H S	- 60	1 7 7	144	0.K.	144	0 0 K	, Q 0	, , ON	· v n	, 0X .

Table 6 (continued)

Polyvinyl Butyral (Bakelite XYHL) Modification of Silicone Resins

			•						TO HOTTON	7777	TCOUR VESTUS				
Vehicle Code	Silicone	2	Compatibility Solution Film		30 day Stability	Air D Dry	Air Dried Film Dry Adhesion	30 min Adh.	30 min @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	36 Fluid 24 hr. Recovery	Lubricant 4 hr. 24 hr	cant 24 hr.
301-11-F SR-32	SR-32	90	Ħ	1	S		•	1							
		75	Ħ	Ħ	S	٣	2	4	0.K	7) O		\$ 1		, ;
		20	II.	Ħ	S	0	9	7	0°K.	· 69	0.K.	s vs	ON	n 🗅	€ ,
301-11-G XR-630	XR-630	90	æ	×	s	-	m	5	0.K.	2) H	c	ĺ	ć	
		75	Н	Ŧ	ß	7	٣	5	0.K	'n	. X	ء د) (.	•
		20	=	ပ	S	0	3	4	0.K.	4	0.K	s o	o N	a w	. OX
301-11-H SR-82	SR-82	9	н		•	,	,	•	1						
		75	н	ပ	တ	0	-	-	×	۰ -	,	. 0		. (. :
		20	æ	ပ	တ	0	7	· —	0.K.	4 m	0 X	n vs	YES	ഗര	<u> </u>
301-11-K DC-840	DC-840	9	н		1	,	•	,	,						
		75	Н	I	s	,			1			ı	1		•
		20	Ħ	H	S	0	٣	3	0.K.	· m	0.K.	ιS	. ON	ıω	, 2
301-11-L R-64	R-64	90	Ħ	ပ	တ	0	2	m	0.18	~	X	6		•	
		22	= ;	ပ	s	0	က	m	0 K	ı m	. X. O	ט ב	ı 2	a v	, 5
		20	#	ပ	S	0	m	9	0.K.	e	0.K.	S	NO.	o o	2 2
301-11-M SR-120	SR-120	9	H		,	ı	1		(
		75	æ	H	S		•		• •				•		
		20	Ħ	1	S	1	•		ı		1 1		' '		
301-11-N R-4471	R-4471	90	Ħ	I	S			•	1		ı				
		75	Ŧ	I	S				•					•	•
		20	Ħ	ı	H		ı		,	,	•	1			
														,	•

Key to Numerical Ratings and Symbols

Adhesion Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	C - Compatible H - Hazy S - Stratified
<u>Dry</u> Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky		ų.
Rating 0	1	2	က	4	5	Compatibility	C - CompatibleH - HazyI - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

- 33 -

Table 7

SR-28 90 SR-261 90 SR-111 90 SR-98 90 SR-17 90 SR-17 90 ST-847 90 DC-802 90 DC-802 90

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Styrene Butadiene (Pliolite S-5) Modification of Silicone Resins

Vehicle Code	Silicone	ы	Compatibility Solution Film	30 day Stability	Air Dry	Air Dried Film Dry Adhesion	30 mir	30 min @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	Lubr 4 hr. Immers.	Lubricant r. 24 hr. ers. Recovery
301-34-K	301-34-K DC-803	828	000	တ လ လ	010	m m 4	w w 4	0.K. 0.K.	m m 4	0.00 K.	000	-	900	
301-34-1	301-34-L DC-806A	87. 80.	000	ပပပ	000	ოოო	m m 4	0.K.	ღ ღ 4	0.K. 0.K.	۵۵۵	1 1 1	000	
301-35-A	R-6-0031 90 75 50	1 90 75 50) I)	ഗ 1 ഗ		4 1 W	m 1 4	0.K.	7 1 7	0.K.	מיו מ	NO - YES	מומ	, , <u>0</u>
301-35-B	s SR-119	90 75 50	000	တ ဟ ဟ	2 2 1	1 1 7	114	0.K.	114	0.K.		1 1 1	ıιω	1 1 02
301-35-C	ST-856	90 75 50	000	w w w	010	ଷଳନ	7 m 4	0.K. 0.K.	6 6 4	0.K. 0.K. 0.K.	QQS	- YES	တ လ လ	0 0 0 0 0 0
301-35-D	xR-856	90 75 50	000	တ တ တ	000	44 E	r r 3	0 0 0 .K.	m 4 4	0.K. 0.K.	000	ilt	0 0 0	1 1 1
301-35-E	DC-805	90 75 50	000	ഗ ഗ ഗ	0 0 0	444	432	0 0 0 .K.	787	0.K. 0.K.	000	1 1 1	969	1 1 1

Table 7 (continued)

Table 7 (continued)

			St	Styrene Butad	iene (e Butadiene (Pliolite S-5) Modification of Silicone Resins	-5) Mod	ification	of Sil	icone Resi	s l			
Vehicle Code	Silicone	ы	Compatibility Solution Film	30 day Stability	Air D	Dried Film Adhesion	30 min	30 min @500F. Adh. Film Integrity	Adh.	G500F. Film Integrity	MIL-S-31 4 hr. Inmers.	MIL-S-3136 Fluid 4 hr. 24 hr. Inmers. Recovery	Luby 4 hr. Immers.	Lubricant 24 hr.
301-35-F	SR-32	828	000	တ လ လ	250	ıım	ıım	0 . r	ıım	, i c	116	1 1		:
301-35-6	XR-630	90 75 50	0 U U	တ လ လ	0 0	ოოო	200	0 0 0 .K.	200	0 0 0 K.	9 888		ന ഗമ	O O 1
301-35-н	SR-82	90 75 50	υ π υ υ υ υ	တပပ	0 0 0	464	644	0 0 0 K.K.	644	0 0 .K.	000	111	3 <u>0</u> 0%	§
301-35-K	DC-840	90 75 50	##U	တ ပ ပ	000	7 7 6	m 4 4	0 0 0 X X X	€ € 4	0.K.	999		2 888	2 11
301-35-L	R-64	90 75 50	± 0 0	လ လ လ	000	¢ 8 3	484	0 0 0 K.	444	0.K.			9 888	
301-35-M	SR-120	90 75 50	ооо жоо	യ യ യ	5 5 0	1 1 4	1 1 6	0.K.	וומ	0.K.	110		, , , w	1 1 S
301-35-N	R-4471	90 75 50	000 000	လလ	0 0	m 4 4	6 4 4	0.K. 0.K. 0.K.	m m 4	0.K. 0.K.	000		999	

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Key to Numerical Ratings and Symbols

Rating	Dry	Adhesion
0	Hard	Excellent
	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Good
m	Slightly tacky	Fair
4	Tacky	Poor
۲	Very tacky	Extremely Poor
Compatibility		Stability
C - Compatible H - Hazy I - Incompatible		C - Compatible H - Hazy S - Stratified

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

F. Triazine Formaldehyde Modification of Silicone Resins.

- The compatibility of silicones and Uformite M-311 was fairly good.
- Many of the coatings were still quite tacky after a
 24-hour air dry period.
- Resistance to the test fluids, particularly to the diester lubricant, was very poor.
- 4. Heat resistance was good.
- 5. For details of Uformite M-331 modifications of silicone resins, see Table 8.

G. Polyvinyl Formal Modification of Silicone Resins

- The compatibility of silicones and Formvar 7/70 was very poor.
- The best resistance to the test fluids was obtained with coatings containing 50% Formvar 7/70.
- The film integrity of the coatings after the 500°F.
 heat exposure was good.
- 4. For details of Formvar 7/70 modifications of silicone resins, see Table 9.

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Table 8

Triazine Formaldenyde (Uformite M-311) Modification of Silicone Resins

Vehicle			Compatibility		30 day	Air Da	Air Dried Film	30 min @500F	@500F.	2 hr.	@500F.	MIL-S-3136 Fluid	36 Fluid	Lubricant	cant
Code	Silicone	14	Solution		Stability	Dry A	Adhesion	Adh.	Film Integrity	Adh.	Adh. Film Integrity	4 hr. Immers.	24 hr. Recovery	4 hr. Immers.	24 hr. Recovery
301-38-A	SR-28	90	ပေး	ပ	ပ	ς,	,	•		•		•		•	•
		C :	٠ د	۰	ی	^			ı	ı		•	,	•	•
		20	ပ	ပ	ပ	က	4	m	0.K.	m	0.K.	Q	1	Ω	
301-38-B XR-261	XR-261	90	ပ	Ų	ပ	1	3	4	0.K.	4	О.К.	Ω	ı	Ω	
		75	ပ		ပ	-	m	4	0.K.	7	0.K.	Ω	ı	Q	ı
		20	Œ	ပ	H	0	2	9	0.K.	4	0.K.	Ω	ı	Q	•
301-38-C	SR-111	96	æ	Ħ	S	2		1		,	•	,	ı	•	•
		75	H	Ŧ	တ	5	,		1			,		•	•
		20	×	×	S	7	က	2	0.K.	4	0.K.	Q	1	D	•
301-38-D	SR-98	90	Ŧ	Ξ	S	0	ო	5	О.К.	4	0.K.	Q		ם	
		75	н	Ŧ	S	0	4	7	0.K.	ო	О.К.	Ω	•	Ω	•
		20	Œ	Ħ	ဟ	0	e	က	0.K.	4	0.K.	Ω	1	Q	1
301-38-E	SR-17	96	Ħ	H	S	5	•			,	•	ı	1	•	
		75	Ħ	H	S	5	1	•	•	,	•	,	,	•	,
		20	×	Ħ	w	4	9	2	0.K.	2	0.K.	Q	ı	Ω	1
301-38-F	ST-847	96	ပ	ပ	ပ	0	2	2	0.K.	m	0.K.	S	YES	v	ON
		75	ပ	ပ	ပ	0	٦	2	0.K	m	0.K	Ω	•	s	02
		20	ပ	ပ	ပ	0	2	e	0.K.	٣	0.K.	Ω	1	s	ON
301-38-G DC-802	DC-802	90	Ħ	н	S	5		ı	ı	,		ı	1		
		75	Ŧ	Ξ	S	ო	4	4	0.K.	4	0.K.	Ω	•	Ω	
		20	æ	Ħ	ß	ന	3	2	О.К.	4	0.K.	Ω		Ω	•

Table 8 (continued)

Triazine Formaldenyde (Uformite M-311) Modification of Silicone Resins

			•					111221 /12	ירם רדסנו סי	7	TCODE RESIDS			
Ventcle			Compatibility	30 day	Air D	ried Film	30 min	@500F.	2 hr.	@500F	MII_S_3136 E144	77:12	•	
Code	Silicone	14	Solution Film		Dry	Dry Adhesion	Adh.	Adh. Film Integrity	Adh.	Film	4 hr.	24 hr.	4 hr.	r. 24 hr.
301-38-H DC-803	DC-803	8		s	0	ო	m	0 18	. 4	A 0		necovery inc	Immers	Recovery
		75	C H	s	0	7	, m	0.K	rm		ח ב	YES	a 6	
		20		(A)	0	2	3	0.K.	4	0.K.	s o	, Q	a	
301-38-K	301-38-K DC-806A	6		တ	0	9	က	0.K.	4	X O	6		4	
		2 2	# :	S) (0	2	٣	0.K.	. 4	0	s o	YES	a c	• (
		2		va	0	2	2	0.K.	e	0.K.	S	YES	a 0	
301-38-L	301-38-L R-5-0031 90	06 1	ပ	ပ	0	٣	4	0.K.	m	N C	v	Q	ć	
		() (ပ	-1	Э	7	0.K	· (*)	0.K) v	2 2	ء د	
		20		ပ	0	2	2	0.K.	m	0.K.	о д	2 ,	2 Q	
301-38-M SR-119	SR-119	90		ပ	5		ı	•	ı					
		75	ပ	ပ	2	•	,	,				t	ı	
		20		ပ	1	3	7	0.K.	4	0.K.	ıω	YES	י ב	• (
301-39-A	ST-856	90		ပ	0	2	m	<u> </u>	~	5		}	, ,	
		75	O I	ပ	0	2	,	, K	2 0		ء د	• •	۵ د	
		Š		ပ	0	2	7	0.K.	ı m	0.K	a 6		۵ ۵	
301-39-B	XR-856	9		Ø	0	~	7	<u> </u>		2	c	;		
		75	Н	s	0	2 0	1 7		† ~	. K	י מי	YES	Δ	•
		20		ß	0	2	4	. K.	1 4	0 K	nΩ	YES-	A 6	
301-39-C DC-805	DC-805	9		vs	۲.		1						,	
		75	H	S	י יח			i (•	ı	•	ı
		20		S	0	က	e	0.K.	ıπ	0.K		' 1	، د	•
									,		1		•	1

Table 8 (continued)

				III	Triazine Form	aldeh)	'de (Uformi	te M-31	1) Modific	ation	Formaldehyde (Uformite M-311) Modification of Silicone Resins	e Resins			
Vehicle	Silicone	ы	Compatibility Solution Film		30 day Stability	Afr D	Air Dried Film Dry Adhesion	30 min	30 min. @500F. Adh. Film Integrity	2 hr. Adh.	G500F. Film Integrity	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lub 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-39-D SR-32	SR-32	8 22 50	= = =	==	လ လ လ	~ ~ ~ ~		1 1 1		1 1 1		1 4 5		1 1 1	• • •
301-39-E	XR-630	82 25 50	# # #	= = =	ποs	0 0	388	44 M	0.K. 0.K.	466	0.00 X.X.	606		ρwν	, 02 0X
301-39-F	SR-82	90 75 50	ပပ၁	ပပပ	000	000	3 5 5	n n 4	0 0 0 X X Y	464	0.K. 0.K.	000	111	888	1 1 1
301-39-G	DC-840	90 75 50	0 0 0	υ છ	ပပာပ	000	3	r † †	0.K. 0.K.	4 c u u	0.K. 0.K. 0.K.	000	1 4 1	9 4 9	1 1 4
301-39-н	R -64	90 75 50	ပပ ပ	υ ບ υ	υυυ	000	1 5 1	നനാന	0.K.	r 7 7	0.K. 0.K.	a S U	YES YES	9 6 9	
301-39-K SR-120	SR-120	90 75 50	ပပပ	ပပပ	ပပပ	0 5 2	- 4 6	5 2 2	0.K.	ınn	0.K. 0.K.	, 0 0	1 1 1	100	
301-39-L R-4471	R-4471	90 75 50		3 0 ±	жσж	000	m 4 4	7 7 7	0.K. 0.K. 0.K.	4 m m	0.K.	Q o Q	YES	666	

Key to Numerical Ratings and Symbols	Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	C - Compatible H - Hazy S - Stratified
Key to Numeri	Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky		Q.
	Rating	0	1	2	8	4	2	Compatibility	C - Compatible H - Hazy I - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

Yes - Recovered original properties No - Did not recover original properties

U - Unaffected
S - Softened
D - Dissolved

Table 9

Polyvinyl Formal (Formwar 7/70) Modification of Silicone Resins

Venicle Code	Silicone	1	Compatibility Solution Film		30 day Stability	Air I	Air Dried Film Dry Adhesion	30 min.	30 min. @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3 4 hr.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	Lubi 4 hr.	Lubricant 24 hr.
301-42-B	SB-2 8	828	# # #	ı # #	ı va va	1 50 50	1 I M	ıιm	0.K.	ווה	0.K.	110	YES	115	
301-42-C XR-261	XR-261	828	##	ннн	တ တ 표	1	ı m 4	188	0.K.	351	0 .K.	ı w w	NO YES	. 0 5	
301-42-D SR-111	SR-111	90 75 50	***	##	တ လ လ	455	ווה	ווה	0.K.	ıιm	- - 0.K.	1 1 30	ı , <u>X</u>	5	
301-42-E	SR-98	% 25 80	z z z	≖ ∪∪	တ လ လ	- 0 O	4 M 4	ოოო	0.K. 0.K.	ოოო	0.K. 0.K.	ល ដ ល	NO	מממ	
301-42-F	SR-17	90 75 50		= = =	လ လ လ	4 0.0	ווא	1 1 1		1 1 1		1 1 1			
301-42-C	ST-847	90 75 50	# ##	ООН	SHH		നന 1	നന 1	0.K.	1 3 2	0.K.	991	1 1 1	991	1 1 1
301-42-н рс-802	DC-802	82.8 50.23	* # *	## #	တ လ လ	2 2 4	4	114	 0.K.	114	0.K.	1 1 0	YES	ιισ	YES

Table 9 (continued)

Polywinyl Formal (Formwar 7/70) Modification of Stlican Profes

Vehicle Code														
	Silicone	2	Compatibility Solution Film	30 day Stability		Air Dried Film Dry Adhesion	30 min. Adh.	@500F. Film	Adh.	@500F. Film	MIL-S-3136 Fluid 4 hr. 24 hr.	36 Fluid 24 hr.	dul 4	Lubricant 24 hr
# 67 106		į						Integrity	·	Integrity	Immers. R	Recovery	Immers.	Recovery
301-42-K DC-803	DC-803	8 :	ນ :	တ	0	٣	4	0.K.	7	2	£			
		Ç 5		S	0	e	4	0.K	. 4	. N	ט נ	, 5	a ;	•
		2		S	0	5		•	. ,		וים	2 .	> (•
301-43-A DC-806A	DC-806A	8		U	•	c	ď						•	•
		75	: =	3 V	> 0	า <	~) (0.K	က	0.K.	Q	•	Q	•
		20		v	o c	,	η,	0.K	س	0.K.	s	NO	Ω	
				מ	>	t	4	0.K.	7	0.K.	S	YES	Þ	
301-43-B R-6-0031	R-6-0031	8	н	O.	~	~	ç	:	•)	
		75	H	o vo	· –) ~	.		m (0.K	S	NO	Q	,
		20		ı v	٠-	٠ ،	n (. Y.	· •	0.K.	S	QV	S	QN
)	-	t	า	0.K.	m	æ	S	YES	ħ	} ,
301-43-C SR-119	SR-119	8		တ	C	"	c	:	()	
		75	Э	S	0	· ~	o ~	Y. S		0.K	S	NO	Ω	•
		20		S	· C	7	י ר		າ ເ	0.K	S	NO NO	Ω	•
				,	•	r	n	K.	m	0.K.	S	YES	Đ	•
301-43-D	ST-856	8		S	c	۲,	·	:	,					
		75	H	S	· c	, ,	,	. K.	· ·	0.K.	S	NO NO	Ω	
		20		S	· c	ı <) (.n .	0.K.	Ω		Ð	•
)	•	^	o.k.	4	0.K.	S	ON	n	,
301-43-E	XR-856	06		s	cr.	7	~	:	,					
		75		v		ተኖ	,	. K.	m	0.K.	Q	•	Q	
		20) C	o v	٦ ,	n ~	4	0.K	4	0.K.	S	NO		
)	7	4	4	о.к.	4	0.K.	S	YES	· =	
301-43-F	DC-805	90		v	٠	1						i I)	1
		75	#	o va	י נ					,	1	1	,	
		20		· v	, 0				ı		ı	•	1	•
		ı)	4	4	4	0.K.	4	0.K.	s	YES	Ω	

Table 9 (continued)

			Pol	Polyvinyl Forma	1 (For	1 Formal (Formwar 7/10) Modification of Silicone Resins	Modifi	cation of	Silico	ne Resins				
Venicle	Silicone	24	Compatibility Solution Film	30 day	Air D Dry	Air Dried Film Dry Adhesion	30 min	30 min @500F. Adh. Film Integrity	Adh.	2 hr. @500F. Adh. Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	136 Fluid 24 hr. Recovery	Lub 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-43-G SR-32	SR-32	90 75 50	* # #	ഗ ഗ ഗ	522	114	ıιm	0.K.	116	0.K.	ι ι ω	- YES	- · · ·	• • •.
301-43-H XR-630	XR-630	90 75 50	н н н	လလလ	010	80 I E	ıιm	 0.K.	1 1 11	 0.K.	1 1 0	- YES	n	
301-44-A SR-82	SR-82	90 75 50	000	ပပပ	000	നനന	m m 4	0.K. 0.K.	നനന	0.K. 0.K.	თთთ	NO YES YES	Q Q D	
301-44-B DC-840	DC-840	90 75 50	H H H H	တ လ လ	000	നനന	നനന	0.K. 0.K.	ოოო	0.K. 0.K.	თთთ	NO YES YES	ann	1 1 1
301-44-C R-64	R-64	90 75 50	N H H	ഗ ഗ ഗ	000	ოოო	6 8 9	0 0 K.	ოოო	0.K. 0.K.	თთთ	NO NO YES	000	
301-44-D SR-120	SR-120	90 75 50	# # # # # #	ഗ ഗ ഗ	N N N			1 1 1	1 1 1			1.1.1		1 1 1
301-44-E R-4471	R-4471	90 75 50	# # # # #	พพพ	5 - 1	ווה	116	 . K.	ıım	0.K.	ιισ	ı ; Q		1 1 1

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Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	C - Compatible H - Hazy S - Stratified		: for darkening.	Extensive flaking or other loss of film integrity.	24 Hour Recovery
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky]e		O.K No perceptible change except for darkening. B - Blistered	ve flaking or other l	Gasoline and Lubricant Resistance
Rating	0	-	2	m	. 4	رح	Compatibility	C - CompatibleH - HazyI - Incompatible	Film Integrity	O.K No percep B - Blistered	N.G Extensiv	Gasoline and L

Yes - Recovered original properties No - Did not recover original properties

U - Unaffected
S - Softened
D - Dissolved

H. Modified Alkyd (Petrex SS) Modification of Silicone Resins

- The compatibility of Petrex SS and silicone resins was good.
- 2. Coatings containing Petrex SS did not air dry well.
- 3. All coatings were dissolved by the test fluids.
- Heat resistance of coatings containing Petrex SS was good.
- For details of Petrex SS modifications of silicone resins, see Table 10.

I. Epoxy Ester Modification of Silicone Resins

- The compatibility of silicone resins and Midland R-55
 was generally good.
- Only coatings containing 75% epoxy ester air dried satisfactorily.
- Resistance to MIL-S-3136 fluid and diester lubricant was fair.
- 4. Heat resistance of coatings containing Midland R-55 was good.
- For details of Midland R-55 modifications of silicone resins, see Table 11.

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Table 10

Petrex SS Modification of Silicone Resins

						Petrex	SS MODIFIC	ation	Petrex 55 Modification of Silicone Resins	e Kesır	8 <u>1</u>				
Venicle	Silicone	14	Compatibility Solution Film		30 day Stability	Air Dr Dry	Air Dried Film Dry Adhesion	30 min	30 min @500F. Adh. Film Integrity	2 hr. Adh.	@500F. Film Integrity	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubr 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-65-B SR-28	SR-28	823	1 1 1			252			1 1 1				1 1 1		
301-65-C XR-261	XR-261	90 75 50			1 1 1	~~~	1 1 1			1 1 1		1 1 1	1 1 1		
301-65-D SR-111	SR-111	90 75 50		1 1 1	1 1 1	~~~	1 1 1	1 1 1	a 1 1	1 1 1	• • •	i i i	, , ,		
301-65-E	SR-98	90 75 50	ווט	1 1 0	ιισ	2 2 0	ווה	1 1 10	- 0.K.	114	0.K.	1 1 0	1 1 1	ΙIΩ	
301-65-F	SR-17	90 75 50		1 1 1	1 1 1	ν ν ι ν	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	t & t	
301-65-G	ST-847	90 75 50	ပပပ	ပပပ	ပပပ	000	ოოო	ოოო	0.K. 0.K.	300	0.K. 0.K.	000	1 1 1	999	
301-65-н DC-802	DC-802	90 25 50			1 1 1	ᡐᡐᡐ				1 1 1	1 1 1	1 1 1		1 ; 1	

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Table 10 (continued)

		ם	Immers. Recovery	,		י ו		Q	0 0	,		,	· ·	, ,		1	l j
		MIL-S-3136 Fluid				٠,		ı	l 1	•	1 ,	, ,	•	1 1	ì		ı
		MIL-	Immers.	. Q	Ω	٦	Q	0 0	0	1	, ,	۰ ۵	Q	· 0	Ω	1 1	1
	SU	. (d500F. Film	Integrity	0.K	0.K.	0.K.	0.K.	0 O K	0.K.			- 0.K.	0.K.	- 0.K.	0.K.		1
(222	e Resi	2 hr.	,	4.	† 1	m	n	ოო	m	ı .	J	ım.	4	1 4	4		
	Petrex SS Modification of Silicone Resins	30 min @500F. Adh. Film	Integraty	0.K		0.K	• •	0.K.	0.K.	1 1	1	0°.K	o.k.	0.K.	. Y.	• • •	ı
	cation		,	۴ ع	. ,	ი 4		ოო	4		ı	1 00 0	7	149	r i		
	SS Modifi	Air Dried Film Dry Adhesion	ı	ო ო	ı	თ თ	c	n m a	m	1 1	1	. 10 4	٠ .	നന		• •	
	Petrex	Air Dry	۸	00	S	00	,	-00	، د	ᠬᠬ	י ר	00	,	00	2	<i>د</i> د	
		30 day Stability	f (ပပ	1 5	ں د	O	ပေဗ	•		1	нн		æ o	ı	1 1	
		Film	1 (ی ر	1 (ာပ	ပ	Ü (,	1 1	,	# #	ı	≋ບ			
	,	Compatibility Solution Film	ı c	၇ပ	1 0	O	ပ	ပ ပ	,	l j	1	ΞΞ	Ħ	ΞU	,		
		24	90	20		90	06 1	75 50	90	75 50	90	75 50	96	20	96	20	
		Silicone	DC-803		301-65-L DC-806A		R-6-003		SR-119		ST-856		XR-856		DC-805		
	Velifolo	Code	301-65-K DC-803		301-65-L		301-65-M	75 50	301-66-A		301-66-B		301-66-C		301-66-D		

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Table 10 (continued)

Petrex SS Modification of Silicone Resins

					-									
Vehicle	Silicone	14	Compatibility Solution Film	30 day Stability		Air Dried Film Dry Adhesion	30 min	30 min. @500F. Adh. Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Iumers, Recovery	Lub 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-66-E SR-32	SR-32	8 2 2 3 3	1 1 1		~ ~ ~	1 1 1		1 1 1	1 1 1	1 1 1	\$ & \$			
301-66-F XR-630	XR-630	90 75 50	000	ပပပ	000	ღ ო∢	7 7 E	0.K. 0.K. 0.K.	444	0.K. 0.K.	000	1 1 1	999	
301-66-6	SR-82	90 75 50		1 1 1	~ ~ ~	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1		
301-66-н DC-840	DC-840	90 75 50	1 1 1	1 1 1	2 2 2	1 1 1	, , ,		1 1 1	1 1 1	1 1 1	1 (1	1 1 1	1 1 1
301-66-K R-64	R-64	90 75 50	000	ပပပ	000	m m 4	444	0.K. 0.K. 0.K.	444	0.K.	000	; 1 1	000	1 1 1
301-66-L	301-66-L SR-120	90 75 50	1 1 0	1 1 0	2 C C	ווה	114	0.K.	1 1 4	- 0.K.	, . Q	1 1 1	110	1 1 1
301-66-M R-4471	R-4471	90 75 50	H 0 0	၈ ပ ပ	100	1 60 50	1 4 4	- 0.K. 0.K.	ı m m	0.K.	, Q Q	1 1 1	100	1 1 1

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	C - Compatible H - Hazy S - Stratified
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky		
Rating	0	1	2	۴	4	5	Compatibility	C - Compatible H - Hazy I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

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Table 11

Lubricant 4 hr. 24 hr. Immers. Recovery , 02 NO NO YES MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery YES 1118 1118 11,2 2000 Integrity Adh. Film . . 0.K. 0.K. 0.K. 0.K. Epoxy Ester (Midland R-55) Modification of Silicone Resins 0.K. 0.K. 0.K. 0.K. 30 min. @500F. Adh. Film Integrity . . 0.K. Air Dried Film Dry Adhesion 30 day Stability Compatibility Solution Film 64 90 75 50 25 25 25 25 825 25 25 25 25 25 25 25 25 25 25 25 Silicone XR-261 SR-111 SR-98 ST-847 SR-98 SB-17 Vehicle Code 301-69-B 301-69-C 301-69-D 301-69-E 301-69-F 301-69-C

Table 11 (continued)

Epoxy Ester (Midland R-55) Modification of Silicone Resins

Vehicle			Compatib		30 day	Air Dr	Air Dried Bilm	30 542	GEOOF		2 hr @500E	MIT. C 2125 El. 44	7 2143	•	
Code	Silicone	ы	Solution Film		Stability	Dry	Adhesion	Adh.	Adh. Film Integrity	Adh.	Film Integrity	4 hr. 2 Immers. R	24 hr.	4 hr.	24 hr.
301-69-н	301-69-н DC-802	90	1 1			ro ro						1 1		1 1	
		25 25	. =	i O	ı ==	s 0	۱۳	1 8	0.K.	1 7	- 0.K.	ιω	, on	1 20	I .3
301-69-K	301-69-K DC-803	90 75 50 25	0 2 0 2	0 # 0 0	0 H O H	0000	๓๓๓๓	1034	0 0 0 0 . K.	7 7 7 7	0.00 0.K.	တ လ လ လ	NO NO YES	a a w w	1 1 N N
301-69-L	301-69-L DC-806A	90 75 50 25	0 0 0 m	0000	υυυυ	0000	๓๓๓๓		0.00.0 K. K.	3 0 1	0.00 .x .x	O O S S	I I ON ON	D D w w	1 1 2 2
301-69-м	301-69-M R-6-0031	1 90 75 50 25	оонн	0011	0011	0 5 1 1	חוות	4111	0.K.	m , , ,	0.K.	Q	1111	A	
301-70-A	. SR-119	90 75 50 25	111=	1110	=	v v v o	וווה	1118	 0.K.	1118	0.K.	1110	1111	1110	, , , Q
301-70-B	ST-856	90 75 50 25	OHHH	нянс	жжжс	0000	4 E 4 E	0 0 0 0	0.K. 0.K.	1221	0.K. 0.K. 0.K.	9999	1 1 1 1	DDDS	2

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Table 11 (continued)

Epoxy Ester (Midland R-55) Modification of Silicone Resins

Silicone	84	Compatibility Solution Film		30 day Stability	Air D	Air Dried Film Dry Adhesion	30 min. Adh.	30 min. @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	36 Fluid 24 hr. Recovery	Lubi 4 hr. Inmers.	Lubricant 24 hr.
8 25		ပပ	ပပ	ပပ	00	ოო	4 4	0.K.	44	0.K.	sς	ON I	A C	1 (
20		ပ	ပ	ပ	7	9	7	0.K.	٣	0.K.	Ω	,) <u>C</u>	
25		ပ	ပ	ပ	0	ო	-	0.K.	7	0.K.	Q		S	NO NO
96		•	•	1	5		1	•	ı		1	•	•	ı
75		×	Ħ	Ħ	7	en	٣	0.K.	٣	О.К.	ß	ON	۵	, ,
20		ပ	ပ	ပ	-	٣	3	0.K.	က	0.K	S	YES	Ω	•
52		Ŧ	ပ	တ	0	m	7	0.K.	-1	0.K.	S	NO	Ω	•
8		•	•	•	2	•	,	,	,	,	•	,	,	1
75		1	•	•	٠		•	,		•	•			. (
20		•	1	•	5	•			•	•	,	ı		1 1
25		ပ	ပ	ပ	0	e	-	0.K.	1	0.K.	တ	N ON	s o	, Q
8		ບ	ပ	ပ	0	ო	4	0.K.	4	8	c	•	_	í
75		H	H	æ	0	ю	e	0.K.	. ო	0 K	۵ ۵		a 0	
20		H	æ	×	0	ო	7	0.K.	7	0.K	Q	•	, va	CN
22		H		æ	0	m	0	0.K.	0	0.K.	Ω		S	NO.
8		ပ	ပ	ပ	7	٣	4	0.K.	4	0,K.	Q		Ð	
75		ပ	ပ	ပ		m	e	0.K.	7	0.K.	Ω		Ω	
20		ပ	ပ	ပ	-	3	n	0.K.	4	0.K	Q		S	ON
22		ပ	ပ	ပ	0	e	7	0.K.	2	0.K.	S	ON	S	0X
8		ပ	ပ	ပ	7	7	က	0.K.	4	0.K.	Q		Q	
75		U I	ပ	ပ	7	4	က	0,K.	٣	0.K.	Q	ı	Q	
9		יט	ບ່	ပ ်	0	m	0	0.K.	٣	0.K.	Q		Ω	
?		ပ	ပ	ပ	0	m	7	0.K.	~	0.K.	s	NO	S	ON

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Table 11 (continued)

	Lubricant 4 hr. 24 hr.	Inners, Recovery D -	. S	
	MIL-S-3136 Fluid	Immers, Recovery D - D - D - D - D - D - D - D - D - D -	O	N I I I ON
	MIL-S-	Immers, D	S + 1 C	0 Q Q Q S
Resins	2 hr. @500F. Adh. Film	O.K. O.K. O.K.	о.к. о.к.	0.0 0.0 0.0 0.0 0.0 0.0 0.0
licone	2 hr.		7 1 10	1334 2
ion of Si	30 min. @500F. Adh. Film	0.K. 0.K. 0.K.	0.K.	0.K. 0.K. 0.K.
bdificat	30 min.	mmo,	- 110	1313 7
Ester (Midland R-55) Modification of Silicone Resins	Air Dried Film Dry Adhesion	m 4 4 c	י או וי י	ച തനനു
(Midla	Air D Dry	0010	9 99 99 9	0000
Epoxy Ester	30 day Stability	0 0 0 n	: ,,0=	း ပၼပတ
폡	ility Film	0000	, , , , ,	ουπου
	Compatibility Solution Film	0 0 0 z	110=	Ожож
	ы	90 75 25 25	90 75 50 25	90 75 50 25
	Silicone	R-64	SR-120	R-4471
	Vehicle Code	301-70-K R-64	301-70-L SR-120	301-70-M R-4471

Key to Numerical Ratings and Symbols

Adhesion Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability C - Compatible H - Hazy S - Stratifled
<u>Dry</u> Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky	e ble
Rating 0	7	2	۳	4	z.	Compatibility C - Compatible H - Hazy I - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

Yes - Recovered original properties No - Did not recover original properties

24 Hour Recovery

J. Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins

- The compatibility of silicone resins and Midland R-9 was limited.
- 2. It was generally necessary to have 75% R-9 in a coating to obtain satisfactory dry.
- 3. Resistance to the test fluids was poor.
- 4. Heat resistance was good.
- 5. For details of Midland R-9 modifications of silicone resins, see Table 12.

K. Oxidizing Alkyd (Midland R-50) Modification of Silicone Resins

- The compatibility of silicone resins and Midland R-50
 was limited.
- Resistance to the test fluids was slightly better than coatings containing Midland R-9, but was still unsatisfactory.
- 3. Heat resistance was good.
- 4. For details of Midland R-50 modification of silicone resins, see Table 13.

Table 12

Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins

			1											
Vehicle Code	Silicone	14	Compatibility Solution Film	y 30 day m Stability	Air Di Dry	Air Dried Film Dry Adhesion	30 min.	30 min. @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubr 4 hr. Immers.	Lubricant r. 24 hr. ers. Recovery
301-75-B	SR-28	75 50 25	ж о о	က ပ ပ	5335	ımm	. e. t	- 0.K.	. 62	0.K.	- S Q	, Ø ,	100	
301-75-C XR-261	XR-261	75 50 25	±00	ოსს	001	തനന	66 6	0.0. 0.K.	ммю	0.K. 0.K.	ឧសជ	NO I	αww	, 00 OX
301-75-D SR-111	SR-111	75 50 25	и и и	လ လ လ	522	ıım	וומ	o.K.	1 1 4	0.K.	ıιΩ	1 1 1	ιισ	ı ı 8
301-75-E	SR-98	75 50 25	H H H	လ လ လ	110	2	ıım	0.K	1 1 4	 0.K.	1 1 X	ı ı Q	ıια	, , Q
301-75-F	SR-17	25 25 25	# # # # # # # # # # # # # # # # # # #	ഗ ഗ ഗ	5 2 2	1 I M	1 1 7	0.K.	1 1 4	0.K.	1 1 0	111		
301-75-G ST-84/	ST-84/	25 25	о о о ж ж ж	တ လ လ	000	000	3	0.K. 0.K.	e e -	0.K. 0.K.	SOO	ON 1 1	လလလ	0 0 0 0 0 0
301-75-H DC-802	DC-802	75 50 25	ннн	യ യ യ	o 2 0	1 + M	1 1 7	 0.K.	118	 0.K.	۱ ، ۵		1 1 103	2

Table 12 (continued)

Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins

Vehicle Code	Silicone	~	Compatibility Solution Film	y 30 day m Stability	Air D	Air Dried Film Dry Adhesion	30 min.	30 min. @500F. Adh. Film Integrity	Adh.	G500F. Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	136 Fluid 24 hr. Recovery	Lubr 4 hr. Inners.	Lubricant 24 hr.
301-75-K DC-803	DC-803	75 50 25	о о о о о о о о о о о о о о о о о о о	တတ္သ	000	ታ ጠጠ	7 7 7	0.K. 0.K.	7 7 7	0.K. 0.K.	999		a a s	ı ı Ö
301-75-L DC-806A	DC-806A	75 50 25	сжи	s s s	000	3 B &	4 6 6	0.K. 0.K.	ოოო	0.K.	000		00 w	2
301-75-M	301-75-M R-6-0031 75 50 25	75 50 25	OUU	ပေဖဖ	2 2 1	๓๓๓	ოოო	0.K. 0.K.	ოოო	0.K. 0.K.	σ»q	ON 1	Dωw	0 0 0 0 0 0
301-76-A SR-119	SR-119	75 50 25	HURH	SHH	N N M	ווה	1 1 6	0.K.	ווה	0.K.	1 + 0		1 1 03	ON
301-76-8	ST-856	75 50 25	##J	E E E	000	m 02 02	400	0.K. 0.K.	ოოო	0.K. 0.K.	000	1 1 1	១««	, 00 N
301-76-C XR-856	XR-856	,5 50 25	3 3 3	மைவ	0 00	നനന	7 7 7	0 0 ° K	4 m m	0.K. 0.K.	<u>e a</u> a		റ റ	1 1 N
301-76-D DC-805	DC-805	75 50 25	нин	ഗ ഗ ഗ	20	178	- 74	0.K.	140	0.K.	ınd		ı va vı	N NO NO

Table 12 (continued)

				Oxio	lizing Alk	yd (M	Oxidizing Alkyd (Midland R-9) Modification of Silicone Resins	Modific	cation of	Silico	one Resins				
Venicle	Silicone	14	Compatibility Solution Film		30 day Stability	Air I Dry	Dried Film Adnesion	30 min.	G500F. Film Integrity	2 hr.	G500F. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Inmers. Recovery	Lubi 4 ir. Imwers.	Lubricant 24 hr.
301-76-E	SR-32	75 50 25	***	нно	တ လ လ	2 2 0	1 1 8	1 1 8	 0.K.	1 1 8	0.K.	,,,		ι • ω	, , Q
301-76-F	? XR-630	75 50 25	## #	нжж	တလလ	. 0 -	7 7 7	• m m	0.K. 0.K.	146	0.K.	ιαQ	, NO	- 11	
301-76-G	3 SR-82	o 23	ပပပ	ပပပ	0 00	000	നനന	4 6 6	0.K. 0.K.	നനന	0.K. 0.K.	იაი	NO NO	ឧសស	N ON ON
301-76-н	1 DC-840	75 50 25	ပပပ	ပပပ	υυυ	000	ოოო	3 8 6	0.K. 0.K.		0.K. 0.K.	asa	NO I	a s s	NO NO NO
301-76-K	K R-64	75 50 25	エエ ひ	000	SHO	000	๓๓๓	m m m	0.K. 0.K.	നനന	0.K. 0.K.	OSO	NO I	aas	, , <u>Q</u>
301-76-L	. SR-120	75 50 25	## #	≖υ υ	တ လ လ	v ~ ~	ımm	- 8 3	0.K.	1 M M	0.K.	100	t i i	ιρ'n	ı ı g
301-76-r	301-76-M R-4471	75 50 25	##	ပပပ	တတတ	000	888	3 4 4	0.K. 0.K.	446	0.K. 0.K.	αss	, ON N	ρww	0 0 N

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability	C - Compatible H - Hazy S - Stratified
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky		
Rating	0	1	7	e	7	5	Compatibility	C - CompatibleH - HazyI - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery	Yes - Recovered original properties No - Did not recover original properties
Gasoline and Lubricant Resistance	<pre>U - Unaffected S - Softened D - Dissolved</pre>

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Table 13

Oxidizing Alkyd (Midland R-50) Modification of Silicone Resins

Table 13 (continued)

				121010	TETTE UTWA	1	TITOTALIO N-201	TTDOL	LOUITCALION OF	111COL	SITICONE KESINS				
Vehicle Code	Silicone	14	Compatibility Solution Film		30 day Stability	Air D Dry	Air Dried Film Dry Adhesion	30 min.	30 min. @500F. Adh. Film Integrity	2 hr. Adh.	2 hr. @500F. Adh. Film Integrity	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	Lubr 4 hr. Immers.	Lubricant 24 hr.
301-77-K	301-77-K DC-803	25 25	ннн	ပ≖ပ	လလလ	000	777	153	0.0 0.K.	5 2 3	0.K. 0.K.	O S S	ı ON ON	ნნა	, , <u>,</u>
301-77-L	301-77-L DC-806A	75 50 25	## #	ပ≖ပ	യ ശ ശ	000	2 1 1	101	0.K.	2 1 2	0.K. 0.K.	Dωω	ON ON	ნაა	0.00
301-77-M	301-77-M R-6-0031	. 75 50 25	**"	нн		1 1 1	111		1 1 1	1 1 1	1 t 1	1 1 1			
301-78-A	SR-119	75 50 25	OHH	ပပပ	ひェェ	3	315	8 8 8 8	0.K. 0.K. 0.K.	7 E Z	0.K. 0.K.	666	1 1 1	666	
301-78-B	ST-856	75 50 25	###	##	တ လ လ	001	തെപ	0 1 -	B 0.K.		0.K. 0.K.	001		881	
301-78-C	XR-856	75 50 25	## #	πυυ	လ လ လ	000	3112	7 - 1	0.K. 0.K.	153	0.K. 0.K.	000	1 1 1	ava	, N
301-78- D DC-805	DC-805	75 50 25	***	HIC	s so so	11			0.K. B 0.K.	m m 0	0.K. 0.K.	o o s	1 1 Z	0 Q %	ı ı ON

Table 13 (continued)

.

			δl	xidizi	ing Alkyd	(Midlar	Oxidizing Alkyd (Midland R-50) Mudification of Silicone Resins	dificat	ion of Si	licone	Resins				
Vehicle Code	Silicone	14	Compatibility Solution Film		30 day Stability	Air Dr Dry	Air Dried Film Dry Adhesion	30 min.	30 min. @500F. Adh. Film Integrity	Adh.	@500F. Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	36 Fluid 24 hr. Recovery	Lubi 4 hr. Immers.	Lubricant 24 hr.
301-78-E	SR-32	75 50 25	ннн	# ##	တတလ	e 10	3 - 1-	1 - 3	0.K. 0.K.	818	0.K. 0.K.	Q . Q		Q I S	, , <u>S</u>
301-78-F	XR-630	75 50 25	# # #	# # #	လလလ	0 1 0	- 1 - €	ਰ ਾਰ	0.K. 0.K.	4 1 0	0.K.	Q , Q	111	. ທ ເທ	2.2
301-78-G	SR-82	75 50 25	ပပပ	HHO	ooo	000	7 7 7	1 2 2	0.K.	787	0.K.	တ လ လ	YES YES YES	– – – v	
301-76-н	DC-840	75 50 25	ပပပ	ပပပ	ပပပ	000	2 2 1	121	0 0	611	0 0 0 K.	O O W	l c	D O W	. 99
301-78-K	R-64	75 50 25	OHH	ບສບ	Son	000	337	0 1 1	0.K.	777	000 8.8.8	N D N	ONI) DD W	2 112
301-78-L SR-120	SR-120	75 50 25	## #	ပပပ	တ လ လ	0 0 0	3 5 1	222	0.K. 0.K.	3 9 8	0.00 X.X.X	000) DD 0	2 , , 2
301-78-M R-4471	R-4471	75 50 25	= = =	Сн	လလလ	0 , 0	0 - 2		B - 0.K.	4 1 6	0.K. 0.K.	Οια	, , ON	פימ	N ON

Rating O	Key to Numerical Ratings and Symbols Dry Adhesion Hard Excellent	ings and Symbols Adhesion Excellent
	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Cood
3	Slightly tacky	Fair
4	Tacky	Poor
5	Very tacky	Extremely Poor
Compatibility		Stability
C - Compatible H - Hazy I - Incompatible		C - Compatible H - Hazy S - Stratified

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

L. Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

- The compatibility of BRS-2600 and silicone resins was poor.
- Coatings containing 75% BRS-2600 had excellent resistance to the test fluids.
- 3. Most of these coatings blistered when tested at 500°F.
- 4. For details of Bakelite BRS-2600 modifications of silicone resins, see Table 14.

M. Butadiene Acrylonitrile Modification of Silicone Resins

- The compatibility of Paracril CV and silicone resins was limited.
- 2. Resistance to the test fluids was poor.
- Some of the coatings containing 75% Paracril CV decomposed at 500°F.
- For details of Paracril CV modifications of silicone resins, see Table 15.

Table 14

Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

Table 14 (continued)

Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

			1	rnenolic (B	акетте	(bakelite bks-2000) Modification of Silicone Resins	MOGILI	Carlon or	21110	ne Kesins				
Vehicle Code	Silicone	54	Compatibility Solution Film	30 day Stability		Air Dried Film Dry Adhesion	30 min	30 min. @500F. Adh. Film Integrity	2 hr.	G500F. Film Integrity	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	36 Fluid 24 hr. Recovery	Lubr 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-81-H DC-803	DC-803	75 50 25	нн	လ လ လ	0	1110	114	ıı¤	1 1 4	ıım		1 1 1		
301-81-K	301-81-K DC-806A	, 75 50 25	HHH	ννν	100	ımm	ı m 4	о.К.	1 6 7	B .K.	. 9 5		105	1 1 1
301-81-L	301-81-L R-6-0031 75 50 25	11 75 50 25	1 H C	, w O	- 50	ı H 4	ınn	0.K	ı m m	0.K.	· s n	ı Ö ı	. 65	
301-81-M	SR-119	75 50 25		ı w w	110	1110	1 1 11	, , <u>,</u>	1 I M	ιıα			1 1 5	1 1 1
301-82-A	ST-856	75 50 25	. H H	·SE	100	- 1 5	3 11 1	о.К. В	ı m m	- 0.K. B	. Q D	1 1 1	100	
301-82-B	XR-856	75 50 25	- # # # # #	ı w w	.00	ו יע יט	146	B 0.K	146	B O.K.	- Q D		- 05	
301-82-C DC-805	DC-805	75 50 25	***	w w w	100	1 2 4	146	- B O.K.	146	8 0.K.	- Q D	6 f 1	ι α ρ	i ()

Table 14 (continued)

Phenolic (Bakelite BRS-2600) Modification of Silicone Resins

|--|

ייייייי אייייי אייייי אייייי אייייייייי	Adhesion	Excellent	Very good	Cood	Fair	Poor	Extremely Poor	Stability C - Compatible H - Hazy S - Stratified
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky	
	Rating	0	1	2	3	7	ห	Compatibility C - Compatible H - Hazy I - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

Table 15

	icant 24 hr. Recovery		1 1 1		1 1 1	111	1 1 1	
	Lubricant 4 hr. 24 hr Immers, Recove	, Q Q			. 66	• 8 0	- 00	999
, al	36 Fluid 24 hr. Recovery	1 1 1		1 1 1	, , ,	1 1 1	1 1 1	1 1 1
one Resins	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	100		101	100	100	. 00	999
n of Silic	@500F. Film Integrity	O.K. DECOMPOSED	0.K.	- 0.K.	0.K.	0.K.	0.K.	0.K. 0.K. 0.K.
ication	2 hr.	DECC	1 25 25	141	1 20 20	185	140	2 4 2
CV) Modif	30 min. @500F. Adh. Film Integrity	0.K.	0.K.	0.K.	- 0.K. 0.K.	0.K.	0.K.	0.K. 0.K. 0.K.
Paracril	30 min	1 20 20	1 20 20	141	1 20 20	1 20 20	. 45	445
Butadiene Acrylonitrile (Paracril CV) Modification of Silicone Resins	Air Dried Film Dry Adhesion	ויטיט	ויחיח	141	1 10 00	1 50 50	1 10 10	ማ የሳ የሳ
Acryl	Air	1 6 2	.00	141	.00	133	100	466
Butadiene	30 day Stability	. ##		. = .	ı so II	, vs ==	. # #	SHH
	Film	100	וטט	1 = 1	ı ¤ U	, # O	100	πυυ
	Compatibility Solution Film	ння	# # #	нжн	# # #	# ##	## #	= = =

75 50 25

301-88-A SR-28

Vehicle Code Silicone Z

25 25

301-88-B XR-261

75 50 25

301-88-C SR-111

75 50 25

301-88-D SR-98

25 25 25

301-88-E SR-17

75 50 25

301-88-F ST-847

75 50 25

301-88-G DC-802

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Table 15 (continued)

Butadiene Acrylonitrile (Paracril CV) Modification of Silicone Resins

Vehicle			Compatibility		30 day	Air D	ried Film	30 min.	@500F.	2 hr.	@ 500F.	MIL-S-3	136 Fluid	Lub	Lubricant
Code	Silicone	54	Solution Film		Stability	Dry	Dry Adhesion	Adh.	Adh. Film Integrity	Adh.	Film Integrity	4 hr. Immers.	4 hr. 24 hr. Immers. Recovery	4 hr. Immers.	24 hr. Recovery
301-88-н	301-88-н DC-803	25	X 3	# (so s	0 0	4 u	4 u	0.K.	N.	0.K.	A	•	A	
		22	=	υ	c ==	0	n v1	n v	0 0 K	ი თ	. ×.	9 0		a a	
301-88-K	301-88-K DC-806A	75	Ħ	Ŧ	æ	0	7	4	0.K.	'n	0.K.	Ω	,	6	•
		50	5 5 3	ပ	z :	0 (יטי	יטי	0.K.	5 .	0.K	Q	•	a	•
		3	E	ر	E	>	^	^	o.ĸ.	S	о.к.	Ω		Ω	•
301-88-L	301-88-L R-6-0031 75	. 75	æ	н	s	-	7	4	0.K.	4	0.K.	Q		a	ı
		20	æ	ပ	S	0	٣	S	0.K.	Ŋ	0.K.	Ω	•	A	
		25	æ	ပ	H	0	m	2	0.K.	5	0.K.	Ω	1	۵	•
301-88-M	I SR-119	75	1	•	,	ı		•		,		•			ı
		20	Ħ	ပ	Н	3	3	S	0.K.	'n	0.K.	Q		Q	
		22	æ	ပ	Ħ	7	4	2	0.K.	S	0.K.	Ω	1	A	,
301-89-A	ST-856	75	Ξ	Ħ	s	0	٣	ო	0.K.	٠	0.K	Ω	ı	Q	
		20	Ħ	ပ	S	0	e	٣	0.K.		0.K.	Ω	•	Ω	
		22	Œ	ပ	×	0	4	2	0.K.	S	0.K.	Q	ı	Q	
301-89-B	XR-856	75	Ħ	Ħ	s	0	m	4	0.K.	2	0.K.	Q	ı	Q	
		20	Ħ	ပ	S	0	က	2	0.K.	5	0.K.	Q	1	Ω	•
		22	Ħ	ပ	Ŧ	0	4	5	0.K.	2	0.K.	Д	ı	Q	ı
301-89-C DC-805	DC-805	75	×	н	s	•	•	,		,		,	ı		,
		50	Ħ	ပ	S	0	5	4	0.K.	5	0.8.	Q	ι	c	
		22	æ	ပ	S	0	5	5	0.K	'n	0.K	Q	•	, <u>a</u>	

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Table 15 (continued)

				Butao	tadiene Ac	ryloni	trile (Par	acril C	/) Modific	ation	diene Acrylonitrile (Paracril CV) Modification of Silicone Resins	e Resins			
Vehicle	Silicone	12	Compatibility Solution Film		30 day Stability	Air Di Dry	Air Dried Film Dry Adhesion	30 min Adh.	30 min. @500F. Adh. Film Integrity	2 hr.	@ 500F. Film Integrity	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubi 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-89-D	SR-32	75 50 25	H # #	CHI	·SE	0	115	110	0.K.	1 15	 0.K.	1 1 0	1 1 1		
301-89-E	: XR-630	75 50 25	нжж	. # O	·SE	- 20	1 20 20	1 25 25	0.K.	1 20 20	0.K.	100	1 1 1	100	
301-89-F	SR-82	75 50 25	нжж	100	1 ##	.00	1 N N	. 2.2	0.K.	5 DECO	- 5 0.K. DECOMPOSED		1 1 1	. 66	
301-89-G	. DC-840	75 50 25	нжж	100	ı SE	, 00	ıvv	1 20 20	0.K. 0.K.	- 5 DECO	- 5 0.K. DECOMPOSED	. D D	1 1 1	. 60	1 1 1
301-89-н	1 R-64	75 50 25	ння	100	· # #	. 0 0	1 10 50	1 20 20	0.K.	1 20 20	o.K.	1 0 0	1 1 1	100	1 1 1
301-89-K	sr-120	75 50 25	нян	LHO	·om		114	ı ım	0.K.	115	0.K.	, , 0		0	
301-89-1	301-89-L R-4471	75 50 25	ння	100	· o ≖		* 20 20	. 5.5	0.K.	- 5 DECO	- 5 0.K. DECOMPOSED	. 00	1 1 1	- 00	1 1 1

Adhesion	Excellent	Very good	oft Good	Fair	Poor	Extremely Poor	Stability C - Compatible H - Hazy S - Stratified	7044415411
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky		
Rating	0	1	2	က	4	s	Compatibility C - Compatible H - Hazy I - Incompatible	

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery	Yes - Recovered original properties No - Did not recover original properties
Gasoline and Lubricant Resistance	<pre>U - Unaffected S - Softened D - Dissolved</pre>

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N. Natural Fossil Resin (RBH 510) Modification of Silicone Resins

- The compatibility of RBH 510 and silicone resins was fairly good.
- Resistance to the diester lubricant was quite good but resistance to MIL-S-3136 fluid was poor.
- Heat resistance of coatings containing RBH 510 was poor. Flaking, blistering, and decomposition were all noted.
- 4. For details of RBH 510 modifications of silicone resins, see Table 16.

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Table 16

Natural Fossil Resin (RBH 510) Modification of Silicone Resins

							700	TO CONTINUE OF		STITCONE RESIDE	Ωİ			
Vehicle Code	Silicone	14	Compatibility Solution Film	Y 30 day	Air Di	Air Dried Film Dry Adhesion	30 min.	30 min. @500 F. Adh. Film	2 hr.		MIL-S-31 4 hr.	MIL-S-3136 Fluid 4 hr. 24 hr.	HI.	Lubricant 24 hr.
	;	į						711787117	•	TULEBETEN	Immers.	Kecovery	Immers.	Recovery
301-92-A SR-28	SR-28	7.5	-	•		•	ı	•	,	•	•	ı		
		လ	o o	ບ	0	Ŋ	S	N.G.	7	0.16.	· c	1 1	ן ב	•
		25			0	S.	S	Z.G.	۸.	N.G.	a D	. 1	9 0	
301-92-B	XR-261	75			0	4	5	0.16.	4	N C	6	,	¢	
		20	S	. .	0	5	2	S		z	9 6	: ()	
		52			0	4	2	N.G.	٠	Z.G.	a 6		o	
301-92-C SR-111	SR-111	75		н	ო	4	4	X	7	A	•		•	
		20	H		က	4	. م	Z Z	•	2 2	ء د	•	ء د	•
		25		Ħ	0	5	2	Z.G.	, v	S C	a a		a 5	
301-92-D	SR-98	75		=	0	'n	ſ.	2	v	2	•			
		20	H	#	0	4	Ś	z	, v	2	a		٦ د	
		52			0	5	2	N.G.	. 5	Z.G.	a 0		2 5	
301-92-E	SR-17	75			9	æ	4	0.K.	7	3	_		ć	
		20	ပ (ပ	0	ς.	5	N.G.	. ح	Z Z	a E		a =	•
		3			0	4	2	N.G.	5	N.G.	. α	•	,	, ,
301-92-F	ST-847	7.5			0	m	m	X	~	5	٤			
		20	H	111	0	m	2		DECOMB	Jern	ے د	•	a (
		22			0	2	15		5 N.G.	N.G.	a a		a 5	
301-92-G DC-802	DC-802	75			0	5	7	X	*	<u> </u>	ſ		,	
		20	o o	ပ	0	4	۰ ح		1 4		ے د	. (ء د	•
		23			0	2	2	N.G.	. ئى	S		· 1	o ==	
										•	l		•	1

Table 16 (continued)

Natural Fossil Resin (RBH 510) Modification of Silicone Resins

원							
Lubricant 24 hr. rs. Recovery		1 1 1		1 1 1	1 1 1		1 1 1
Lub 4 hr. Immers.	9 5 5	995	۵.,	Q : D	955	605	665
MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	1 1 1						
MIL-S-33	999	000	۵.,	ΩιΩ	808	600	000
G500F. Film Integrity	0.K N.G.		0.K.	O.K.	N. C. K	0.K B B K.	N O N O
2 hr. @500F Adh. Film Integr	4 N N	6 7 J	8	4 1 2	285	m 4 4	6.4 r
G500F. Film Integrity	N.G. G.G.	N N N N N N N N N N N N N N N N N N N	0.K.		N N N N N N N N N N N N N N N N N N N	N N N N N N N N N N N N N N N N N N N	N.G.
30 min. @500F. Adh. Film Integri	4 N N	4 N N	mıı	спи	an nu nu	4 W W	420
Air Dried Film Dry Adhesion	พ4พ	4 v v	רוו פ	4 - 2	7 7 5	444	455
	000	000	⊣ 1 1	410	000	000	000
30 day Stability	ပပပ	**	# 1 1	SSE	ပပပ	# ##	##
Film	ပပပ	ပ≖ပ	011	жно	ပပပ	ヸ゙゙゙゙゙ヹ゙゙゙゙゙゙゙゙゙゚	υπυ
Compatibility Solution Film	ပပပ	###	жнн		ပပပ	= = =	##
14	75 50 25	75 50 25	1 75 50 25	75 25 25	75 50 25	75 50 25	75 50 25
Silicone	DC-803	DC-806A	R-6-003]	SR-1 19	ST-856	XR-856	DC-805
Vehicle	301-92-н DC-803	301-92-K DC-806A	301-92-L R-6-0031 75 50 25	301-93-A	301-93-B	301-93-C XR-856	301-93-D DC-805

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Table 16 (continued)

Natural Fossil Resin (RBH 510) Modification of Silicone Resins

				:1	Martin Losal Mestn (MbH 010) Modification of Silicone Resins	מדד שבי	C HON ITS	TO WOO	IIIcation	of Sil	icone Resir	SE			
Vehicle Code	Silicone 7	14	Compatibility Solution Film		30 day Stability	Air D	Air Dried Film	30 min	30 min. @500F.	2 hr.	2 hr. @500F.	MIL-S-31	MIL-S-3136 Fluid	du.	Lubricant
							ilot eating		Integrity	Adh.	×	4 hr. Immers.	24 hr. Recovery	4 hr.	24 hr.
301-93-E SR-32	SR-32	75	Ħ	ပ	=	~	~	,	3	,					
		20	æ	1	e va) (۱ ۱	ור	. O. K.	7	0.K.	Δ		۵	•
		22	H	ပ	S	0	5	ונה	, z	יי	z.G.	- Q	1 1	۱ :	•
301-93-F XR-630	XR-630	75	×	I	Ø	O	7	4	\$,		i i		5	
		20	æ	н	S		٠,	۱ ۱	•	n	o.K.	Ω		Q	•
		25		ပ	တ	0	5	S	N.G.	٠ ٠	, Z	۰ ۵		1 =	•
301-93-G SR-82	SR-82	75	=	ပ	Ξ	c	٧.	ц	;			ı	i	5	•
		20			: =:	· -	יי ל	י ר		.	0.K	A	•	Q	•
		52		ပ	×	0	ı vı	ט יט		U r	o c	A	ı	Ω	•
,								,	•	1	•	2		Δ	•
301-93-н	DC-840	75	= :	ပ	H	0	4	5	S. S.		<u>s</u>	-		,	
		0 0		≖ (# :	0	4	2	Z.	'n	2	9 6	• 1	ء د	
		3		ن	æ	0	2	2	Z.G.	~	S	a 0) 1	⊃ ::	
301-93-K	R-64	75		ပ	U	c	۳,	u	2		,			•	ì
		20	o	ပ	U) <	ם ר	٠ د :	t ,	0.K	Ω	•	Ω	•
		25		ပ	ပ	0	4	רי ר		۰ رر	o c	P 6	•	A :	•
301-93-L	SR-120	75		ن	v	r	,	•		,	•	2	ı	-	•
		20	=) - -	o v	ו ר	า	~	0.K.	7	Ø	Ω		Q	•
		25		יט	ט נ						•	•	•	1	۱ ا
				,	ò	>	1	^	z.G.	S	N.G.	Ω		D	,
301-93-M R-4471	R-4471	75	# :	H	s	2	m	5	2	"	<u>}</u>	í			
		טל נ		,	တ	0	7	٠,	2	י ר		ء د		Ω	•
		3		ပ	Œ	0	7	2	S	'n	, c	ع د	•	۵ ۵	1
									•)	•	۵.	•	2	

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	Stability C - Compatible H - Hazy S - Stratified	
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky	 1e	
Rating	0	-1	2	m	4	5	Compatiblity C - Compatible H - Hazy I - Incompatible	

Film Integrity

O.K. - No perceptible change except for darkening. B - Blistered

B - Blistered N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

O. Epoxy Resin Systems

- Coatings containing Epon 828 were generally unsatisfactory. Many Epon 828 coatings would not properly cure and many others had a tendency to "crawl" and create an appearance of incompatibility.
- With the exception of Versamid 100, the polyamides successfully cured the epoxies and were judged to be about equivalent in performance. Coatings containing Versamid 100 were sensitive to the MIL-S-3136 fluid but this was probably because Versamid 100 is the slowest reacting polyamide.
- 3. Coatings containing 10% and 25% polyamide (depending on the epoxy used) had the best resistance to the test fluids and had the best over-all film properties.
- 4. The solid epoxies (Epons 1001, 1004, 1007, and 1009) seemed to be about equal in performance with Epon 1009 possibly having slightly superior heat resistance.
- 5. The silicone epoxy copolymers (Dow Corning XR-6-0000 and Midland X-4209) had no better heat resistance than the unmodified epoxies and were slightly poorer than the unmodified epoxies in resistance to the test fluids.
- 6. Dow Corning Z-6020 amino silane appeared to be an effective curing agent for epoxies but had little effect on the high temperature properties of the epoxies which were quite good to begin with.

- 7. The epoxy novolacs (Dow 2638.1 and Dow 2638.3) were all extremely brittle, regardless of the curing agent used.
- 8. Shell H-1 and H-2 curing agents seemed to be worthwhile catalysts with Epon 1001 and the silicone-epoxy copolymers. With Epon 1007 and Epon 1009, however, a large number of eyeholes appear in the coatings after the 500°F. heat exposure. These eyeholes were not present before the heat test. H-1 seemed to be slightly superior in performance to H-2.
- 9. Details of epoxy resin systems may be found in Tables 17-26.

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Table 17

Epoxy-Polyamide (Versamid 100) Resin Systems

Main Code Powy or Pow	Lubricant r. 24 hr. ers. Recovery		YES YES	ON ON I	ı i ON	N O O O
Lompatibility Air Dried Film 30 min. @500F. 2 hr. @500F. 90 I 4 4 4 5	Lub 4 hr. Immers.	iııs	a a b b	8 8 8 D	n n s s	SSSC
Lompatibility Air Dried Film 30 min. @500F. 2 hr. @500F. 90 I 4 4 4 5	3136 Fluid 24 hr.	, , , <u>0</u>	NO NO YES NO	YES NO NO	YES NO NO	NO NO NO YES
Line of Film Dry Adhesion Alr Dried Film Adh. G500F. 20mpatibility Dry Adhesion Adh. Film Integrity 50 I J 4 4 4 55 5 5 1 Integrity 50 I J 4 4 4 55	MIL-S- 4 hr. Immers	1110	ααανα	တ လ လ လ	လ လ လ လ	ν ν ν ν
Line of Film Dry Adhesion Alr Dried Film Adh. G500F. 20mpatibility Dry Adhesion Adh. Film Integrity 50 I J 4 4 4 55 5 5 1 Integrity 50 I J 4 4 4 55	@500F. Film Integrity	 0.K.	0.K. 0.K.	0.K. 0.K. 0.K.	0000 .K. .K.	0.K. 0.K. 0.K.
Z. Compatibility Air Dried Film Dry 30 min. 90 I 5 5 5 - 50 I 4 4 - - 50 I 4 4 - - 50 I 4 4 - - - 50 I 4 4 -	2 hr.	1116	7 5 3 3 1	2822	21123	3 2 3
Tellm Air Dried Film 90 1 5 5 50 1 4 4 4 50 1 4 4 4 50 1 4 4 4 50 1 4 4 4 50 1 4 4 4 50 C 4 3 3 50 C 2 3 1 50 C 1 3 3 50 C 1 3 3 50 C 1 4 4 50 C 0 3 4 50	n. @500F. Film Integrity	 0	0000 K.K.	0.0 0.8 0.0 0.8	0.K. 0.K. 0.K.	0.K. 0.K. 0.K.
Film Compatibility	30 mi		0 0	7 7 7 7	0000	0011
Film Compatibility	Adhesion	2446	5 H 3 3	01 m m m	m 4 4 4	mm44
7 90 75 75 75 75 75 75 75 75 75 75 75 75 75		v 4 4 4	8388	0	4150	0064
	Film Compatibility	ннно	UUUU	υυυυ	0000	∪∪
Vehicle Epoxy or Code Epoxy Co-Polymer 301-26-E Epon 828 301-26-D Epon 1001 301-26-A Epon 1007 301-26-B Epon 1007		90 75 50 25				
Vehicle Eprode Code Eprode Epr	oxy or oxy Co-	oon 828	1001 noc	on 1004	on 1007	on 1009
	•	301-26-E E	301-26-D E _F	301-26-A EF	301-26-в Ер	301-26-C Ep

Rating	Dry	Adhesion
0	Hard	Excellent
H	Tack-free but slightly soft	Very good
2	Tack-free but Soft	Pooo
e	Slightly tacky	Fair
4	Tacky	Poor
S	Very tacky	Extremely Poor

Compatibility

- C Compatible
- H Hazy I Incompatible

Film Integrity

0.K. - No perceptible change except for darkening. B - Blistered N.G. - Extensive flaking or other loss of film integrity.

- Gasoline and Lubricant Resistance
- U Unaffected
 S Softened
 D Dissolved

24 Hour Recovery

Table 18

Epoxy-Polyamide (Versamid 115) Resin Systems

301-13-E E	Polymer		i .								27,		
301-13-E Epon 828		1 2	Compatibility	Dry	Dry Adhesion	Adir.	Adh. Film Integrity	Adh.	Adh. Film Integrity	4 hr. Inmers.	Inmers. Recovery	4 hr. Inmers.	nr. 24 hr.
	pon 828	90	H	ı	1	•	,	•	•	1	1	•	•
		75	1	,	•	1	ı	•	,	•		ı	•
		20	ı	•	•	•	•	•	•	•		ı	
		25	I	ı	i		•	•	•	•	,		•
301-13-D Epon 1001	pon 1001	96	ပ		ო	0	0.K.	7	0.K.	S	Q	v	Q
		75	ပ	0	7	7	0.K	7	0.K.	רי	! .	=	} •
		20	ပ	0	2		0,K	e	0.K.	v	YES	=	•
		25	ပ	e	က	0	0.K.	3	0.K.	တ	ON	b	•
301-13-A Epon 1004	pon 1004	90	ပ	0	5	1	0.K.	n	0.K.	n	ı	Þ	
		75	U	0	5	7	0.K.	7	0.K.	n	1	Ω	
		20	ပ	7	4	-	0.K.	_	0.K.	S	NO NO	n	
		25	ပ	7	7	2	g	4	В	တ	ON	Ω	•
301-13-E Epon 1007	pon 1007	90	ပ	-	ന	-	0.K.	n	0.K.	Ω	ı	n	•
		75	ပ	0	ო	7	0.K.	7	0.K.	ກ	•	n	•
		20	ပ	_	4	٣	В	-	0.K.	S	NO	Ω	
		25	ပ	7	5	m	В	က	g	S	ON	S	Q <u>N</u>
301-13-C Epon 1009	pon 1009	8	U	7	5	ო	0.K.	7	0.K.	Ŋ	•	n	•
		75	ပ	0	4	7	0.K.	7	0.K.	S	YES	n	•
		20	ပ	_	4	7	æ	0	æ	တ	ON	n	•
		25	ပ	7	5	٣	щ	7	89	S	ON	S	NO

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Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Cood	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	-1	2	e	4	٥

Compatibility

C - Compatible H - Hazy

I - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

Table 19

Epoxy-Polyamide (Versamid 125) Resin Systems

			ı									
Vehicle Epoxy or Code Epoxy Co-	ام د ۱	Film Compatibility	Air D	Air Dried Film Dry Adhesion	30 min	30 min. @500F. Adh. Film Integrity	2 hr. @500F Adh. Film Integr	@500F. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	4 hr. Immers.	Lubricant. 24 hr.
301-13-L Epon 828	3 90 75 50 25	нжоо	3746	7 7 7 7	1070	0 0	1010	0 0 0 0 0 0	N C N I	YES NO	מממי	
301-13-K Epon 1001	50 75 50 25	0000	0005	2253	0-101	0.K. 0.K.	1 0 3 5	0.K. 0.K.	ומממ		וממפ	
301-13-F Epon 1004	34 90 75 50 25	OCMO	0005	നനന 1		0.K. 0.K.	2211	0.K.	n n s ı	, , Q, ,	ומממ	
301-13-G Epon 1007	37 90 75 50 25	೮೮೮	2700	0m41	- 515	0.K. 0.K.	ଷଳ ।	0.K. 0.K.	D 88 C	NO NO	ומממ	
301-13-H Epon 1009	39 90 75 50 25	000 ±	0074	0 0 4 W	001.	0.K. 0.K.		0.K. 0.K.	D & & 1	N O O I	5551	

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Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky	
Rating	0	H	7	m	4	5	

Compatibility

C - Compatible H - Hazy

I - Incompatible

Film Integrity

 $0.K_{\bullet}$ - No perceptible change except for darkening. B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected

S - Softened D - Dissolved

Table 20

	Lubricant . 24 hr.		YES					I
	Lub 4 hr. Immers	ממו	200	וומפ	ווממ	ווממ	. nn n	٠:
	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	, , , ,	ı ı N ı		1111		NO YES NO	VEC
	MIL-S-3] 4 hr. Inmers.		n n n	ווממ	ווככ	⊃ :	s s	v:
ystems	G500F. Film Integrity	0.K.	0.K. 0.K.	0.K.	0.K.	0.K. 0.K.	0.K. 0.K.	0. K
) Resin S	2 hr. @Adh.	1001		8411	מת ו ו	ee	1 1 3	7
Epoxy-Polyamide (Versamid 140) Resin Systems	G500F. Film Integrity	0.K.	0.K. 0.K. -	0.K.	0 0 . K. 	00.K	0.K. 0.K. 0.K.	•
yamide (Ve	30 min. @500F. Adh. Film Integri	1001	1001	0111		 11	1 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	ı
Epoxy-Pol	Air Dried Film Dry Adhesion	4004	8004	w w 4 rd	መልካካ	5 5 3 1	2 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
	Air Dr Dry	4004	4315	5 5 6 1	0055	1 5 5	00 00	
	Film Compatibility	0 0 0 #	υυυυ	000 ±	ннсс	рожн	იი იი	

Vehicle Epoxy or Code Epoxy Co- Polymer

301-26-L Epon 828

Dow Corning 301-63-G XR-6-0000 90 75

Midland 301-63-L X-4209

NO YES

s s

0.K. 0.K.

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	-1	2	က	4	٧.

Compatibility

C - CompatibleH - HazyI - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

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Table 21

Vehicle Epoxy or Code Polymer 301-54-E Epon 828 301-54-D Epon 1001 301-54-A Epon 1004		Film Compatibility C C C C C C C C C C C C C C C C C C C	Atr DEY DEY DE S S S S S S S S S S S S S S S S S S	Air Dried Film Dry Adhesion 5	1de (Go	Dried Film 30 min, @500F. 2 hr. @500 Adhesion Adh. Film Adh. Film Integrity Integrity Integrity 3 3 0.K. 3 0.K.	2 hr. Adh. 1	G500F. Film Integrity 0.K. 0.K. 0.K. 0.K. 0.K.	MIL-S31 4 hr. Immers. S S S U U U	MIL-S3136 Fluid 4 hr. 24 hr. Immers. Recovery 5 NO 6 S NO 7 The state of the state	Lub 4 hr. Immers. U U U U U U U U U U U U U U	Lubricant 24 hr. rs. Recovery
301-54-C Epon 1009 301-63-F XR-6-0000 301-63-K X-4209	25 25 25 25 25 25 25 25 25 25 25 25	ນບ ເ	00 4 4 0 0 4 0 0 0 0 m	നെവി നിനി വി നിന്ന	50 32 1150 1153	0.K. 0.K. 0.K. 0.K.	ah aa 1100 1187	0.K. 0.K. 0.K. 0.K.	מא מא וואם וואם	NO NO SAY	מם וומם וומם	1111 1111 11 12

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	e	4	5

Compatibility

C - CompatibleH - HazyI - Incompatible

Film Integrity

O.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected

S - Softened D - Dissolved

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Table 22

Epoxy-Polyamide (Genamid 310) Resin Systems

			3)	ooxy-rolyam	ae lee	Epoxy-rolyamide (Genamid 310) Resin Systems	ssın sy	stems				
Vehicle Epoxy or Code Epoxy Co-Polymer	ы	Film Compatibility	Air I Dry	Air Dried Film Dry Adhesion	30 mi	30 min. @500F. Adh. Film Integrity	2 hr Adh	2 hr. @500F. Adh. Film Integrity	MIL-S-3] 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubr 4 hr. Immers.	Lubricant nr. 24 hr.
301-54-L Epon 828	90 75 50 25	0011	0055	0011	0011	0.K.	0011	0.K.	99:1		s n ı ı	2111
301-54-K Epon 1001	90 75 50 25	OOII	0055	01.1	~~	0.K.	1 1 5 5	0.K. 0.K.	SDII	0 N 1 1 1	SDII	YES -
301-54-F Epon 1004	90 75 50 25	0011	0005	طط ا!		0.0 	ოთ I I	0.K.	וומם	YES	ווממ	
301-54-G Epon 1007	90 75 50 25	0011	0005	04.1	21	0.K 0.K.	mm 1 1	0.K.	וומם	ı ON ı ı	ווממ	
301-54-H Epon 1009	90 75 50 25	0011	0000	0		0.K.	771	0.K. 0.K.	D S I I	, O, , ,	וומם	YES

Adhesion	Excellent	Very good	Poog	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	9	4	5

Compatibility

- C Compatible
- H Hazy I Incompatible

Film Integrity

- 0.K. No perceptible change except for darkening. B Blistered
- N.G. Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

- U Unaffected
 S Softened
 D Dissolved

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Table 23

Epoxy-Polyamide (Lancast A) Resin Systems

	y or		Film	Air D	ried Film	30 min	. @500F.	2 hr.	9500F	MII.S.	136 5144	# · · · · · · · · · · · · · · · · · · ·	
Code Epox	Epoxy Co- Polymer	1	Compatibility	Dry	Dry Adhesion	Adh.	Adh. Film Integrity	Adh. Film Integri	Film Integrity	4 hr.	4 hr. 24 hr. Immers. Recovery	4 hr.	hr. 24 hr.
301-55-E Epon 828	828	8	1	'n	•		,	•	(
		75	ပ	က	-	7	0.K.	2	1	. 0	, 5	ı :	
		20	•	5	•	ı		۱.		•	2	5	
		25	•	2	,		1	•			1 1	• •	•
301-55-D Enon 1001	1001	9	c	c	c	,	:	,				ı	
		2,2	י כ	> C	> c	٦,	0.K	7	0.K.	S	ON	S	YES
		50	, ,	יי כ	>	-	0.K.	7	0.K.	Þ		Þ	•
		25	1	٠ ١	1)		•		•	•		•	•
		3	1	n	ı			•				•	•
301-55-A Epon 1004	1004	90	U	c	,	-	3	c	;				
		75	ن و	· c	٠	۱ ،	. v.	7	o.K.	n	,	D	•
		5.0	, ,	יו כ	o 1	7	0.K.	m	0.K.	s	ON	b	•
		25	•	יט ר	ı	ı	•		ı	•	•	,	•
		}		,	•	ı			,	ŧ	•	•	•
301-55-B Epon 1007	1007	8	ပ	0	0	_	<u> </u>	·	:	:			
		75	ပ	C		، ۱		n (O.K.	>	•	>	
		20	•	'n	۱ د	, ,	. v.	יז	0.K.	တ	ON	S	YES
		25	•	ď	i	I	•		•	ı			•
		}		1	•		•		•	ı		•	1
301-55-C Epon 1009	1009	8	ပ	0	0	0	a C	·	*	c		;	
		75	ပ	0	0	· c		4 (. Y. C	י מ	YES	Þ	•
		20	•	٠.	•) e		4	o.ĸ.	'n	NO	Þ	
		25		י ע		ı		,					
		}	I	1	•	ı		,		•		ų	

Adhesion	Excellent	Very good	Poog	Fair	Poor	Extremely Poo
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Kating	0	.	2	e e	4	'n

Compatibility

C - Compatible

H - Hazy

I - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

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Table 24

Epoxy-Amino Silane (Dow Corning 2-6020) Resin Systems

Lubricant 4 hr. 24 hr. Immers. Recovery	o NO n	י י מ	וו	י י ממ	 n	n n	
136 Fluid 24 hr. Recovery	ON ,	1 1	1 1	1 1		1 1	
MIL-S-3 4 hr. Immers.	s n	n	חמ	n	ממ	ממ	ממ
2 hr. @500F. Adh. Film Integrity	0.K.	0.K. 0.K.	0.K.	0.K.	0.K.	0.K.	0.K.
2 hr.	70	3 5	ოო	m m	0 0	'nм	ო ო
30 min. @500F. Adh. Film Integrity	0.K. 0.K.	0.K.	0,K.	0.K. 0.K.	0.K.	0.K. 0.K.	0.K. 0.K.
30 min Adh.	2	3 0	3 5	1 2	00	ო ო	ოო
Air Dried Film Dry Adhesion	в 0	നന	3.2	7 7	1 2	ოო	7 7
Air D Dry	0 3	5 5	00	00	00	00	0 0
Film Compatibility	ပပ	ပပ	ပပ	ပပ	ပပ	ပပ	ပပ
62	90	90	90	90	90	30 75	90
Vehicle Epoxy or Code Epoxy Co- Polymer	301-63-E Epon 828	301-63-D Epon 1001	301-63-A Epon 1004	301-63-B Epon 1007	301-63-C Epon 1009	301-63-H Dow Corning XR-6-0000 9	301-63-M Midland X-4209

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	H	2	က	4	5

Compatibility

C - Compatible H - Hazy

I - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening. B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

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Table 25

	Comments		Very Brittle	1 1	•		Very Brittle -	1		•	Very Brittle Very Brittle	Extremely Brittle
	Lubricant r. 24 hr.	Recovery		1 1 1	1	1		,	1 1		1 1	
	4	Inners.	מו		ı	1 :	.	1	1 1	•	ממ	Ω
	MIL-S-3136 Fluid 4 hr. 24 hr.	Recovery				•	l f	ı		ı		ı
		Immers.	n	1 1 1		1 5) i	ı	1 1	ı	םם	Ð
2638.1)	2 hr. @500F. Adh. Film	Integrity -	0.K.			1 0	:	•			0 0 K.	Z.G.
B (Dow	2 hr.		e	1 1 1		١ ٥	1 +	ı			7 7	S
in System	30 min.@500F. Adh. Film	Incegrity	0.K.			0	•			:	0.K.	N.G.
lac Res	30 mi	1 1	7	1 1 1		- 2		•		10	n m	5
Epoxy Novolac Resin Systems (Dow 2638.1)	Air Dried Film Dry Adhesion	1 1	7	1 1 1		- 8	•	•		1 6	14	٦
141	Air I	νv	7	1 1 1		5 2	'n	Ω.	ΛN	ر د	7	0
	Film Air Compatibility Dry	1 1	ပ	ннн		ıυ		•		١ ٢	ပ	ပ
	7	.5 10 25	20	10 25 50		10 25	20		3 51	2 5	ខ្ម	1
	Curing Agent	301-96-A Versamid 115 10 25		301-96-B Genamid 250		Lancast A		Dow Corning	0700-7	Diethylene Triamine		301-245-G PMDA Adduct
	Vehicle Code	301-96-A		301-96-в		301-96-C Lancast A		301-96-D		301-96-E		301-245-G

•

Table 25 (continued)

, 2638.3)
(Dow
Systems
Resin
Novolac
Epoxy

	Comments	Very Brittle Very Prittle	Very Brittle Very Brittle	Very Brittle Very Brittle	Very Brittle Very Brittle	Very Brittle Very Brittle Very Brittle
	Lubricant 24 hr.					YES
	4 h	n	וממ	ם מ	. 0 5	n S
	36 Fluid 24 hr Recovery	YES	YES YES	YES	YES	YES -
	MIL-S-31 4 hr. Immers.		တတ ၊	s n .	ı s n	s
2038.3)	2 hr. @500F. Adh. Film Integrity	0.K.	0.K	0.K.	N.G.	0.K. 0.K.
MON SI	2 hr Adh.	1 2 8	881	⊣ n .	1 2 -	101
Mestil Systems (DOW 2038.3)	30 min.@500F. Adh. Film Integrity	0.K.	0.K.	0.K.	N.G.	0.K. 0.K.
		3 5	:	- a -	101	H H Z
	ried Film Adhesion	7 0 1	18.	041	1 7 0	7 0 7
	Air D	3 2 4	1 7 7	. 21	5 4 2	000
	Film Air Dried Film Compactibility Dry Adhesion	100	CHI	# # H	100	ပပပ
	ы	5 10 25 50	10 25 50	10 25 50	2 51 51	10
	Curing Agent	301-96-F Versamid 115 10 25 50	301-96-G Genamid 250	301-96-H Lancast A	301-96-K Dow Corning Z-6020	301-96-L Dietnylene Triamine
	Vehicle	301-96-F	301-96-G	301-96-н	301-96-K	301-96-L

	ACT TO NUME ICAL NACINGS and Symbols	cings and Symbols
Rating	Dry	Adhesion
0	Hard	Excellent
-	Tack-free but slightly soft	Very good
2	Tack-free but Soft	poog
m	Slightly tacky	Fair
4	Tacky	Poor
٠,	Very tacky	Extremely Poor

Compatibility

C - CompatibleH - HazyI - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

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Epoxy - Moisture Activated Catalyst (Shell H-1 and H-2) Systems

Lubricant 24 hr.						1 1 1
Lubi 4 hr. Immers.			ממממ	ממממ	nnnn	n n n
MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery				YES		1 1 1
MIL-S-3 4 hr. Immers.		1 1 1 1	ממממ	s n n	2000	n n
2 hr. @500F. Adh. Film Integrity	- 0.K. 0.K.	1111	0.K. 0.K.	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	EYEHOLES EYEHOLES EYEHOLES	EYEHOLES EYEHOLES EYEHOLES
2 hr.	1126	1 1 1 1	ოოოო	ოოოო	ოოოო	ო ო ოო
30 min. @500F. Adh. Film Integrity	- 0.K. 0.K.	1 1 1 1	0.K. 0.K.	0.K. 0.K. 0.K.	O.K. O.K. EYEHOLES EYEHOLES	EYEHO LES EYEHO LES EYEHO LES EYEHO LES
30 min Adh.	351	1 1 1 1	8888	400%	0000	1 3 3
Air Dried Film Dry Adhesion	 .		3221	9850	m m m 4	w w w 4
Air	9900	សសស	7000	1000	7000	0 0 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7
6-2	5 10 25 50	5 10 25 50	5 25 50	10 25 25 50	5 25 50	5 10 25 50
Curing Agent	H-1	H-2	H-1	н-2	H-1	н-2
Epoxy Resin	301-76-J Epon 828	301-176-K Epon 828	301-176-G Epon 1001	301-176-H Epon 1001	301-176-C Epon 1007	301-176-D Epon 1007
Vehicle Code	301-76-3	301-176-#	301-176-0	301-176-	301-176-(301-176-1

Table 26 (continued)

Epoxy - Moisture Activated Catalyst (Shell H-1 and H-2) Systems

					- kxod	Moisture	<pre>Epoxy - Moisture Activated Catalyst (Shell H-1</pre>	talyst	(Shell H-1 a	and H-2) Systems	ystems		
Vehicle Epoxy Code Resin	Cun	Curing	84	Air D Dry	Air Dried Film Dry Adhesion	30 min.	30 min. @500F. Adh. Film	2 hr.	@500F.	60	MIL-S-3136 Fluid	Inb	Lubricant
				1			Integrity		Integrity	Immers.	Recovery	4 hr. Immers.	24 hr. Recovery
301-176-E Epon 1009	1009 H-1	.	2	0	9		EVEHOLFS	۳	<u> </u>	:			
		•	2	0	٣	m	EYEHOLES	۳ ر	EVEHOLES	> =	•	:	
		••	25	_	m	7	EVEHOT ES	, ~	EVEUOT EC	>:	•	> :	•
			20	7	4	e	EYEHOLES	ne	EYEHOLES	o	1 1	5 5	1 1
301-176-F Epon 1009	.009 н-2		ď	c	(**	·	ou roughe	ć				•	
			9	0) m	7 0	EYEHOLES FYFUOI EC	n c	EYEHOLES	ם :	•	Ω	
			2	, -	, .	1 (PI EUOLES	~ (EXEHOLES	n	•	Þ	•
		•	3 5	٠,	ŋ ·	7	EYEHOLES	7	EYEHOLES	Þ		=	ı
Midland	7	•	2	7	4	က	EYEHOLES	7	EYEHOLES	တ	NO	Þ	
301-177-A X-4209	H-1	_	v	c	-	ď						ı	
			2 د	> <	- 1 (7	0.K.	7	0.K.	S	YES	=	,
		•	70	- د	m •	ო (0.K.	ო	0.K.	S	YES	=	
		•	3.5	٠,	- 1 (m	0.K.	m	0.K	S	YES) :	1
		'	ž	7	7	ო	0.K.	ო	0.K.	S	YES	o =	• 1
301-177-B Midland	d H-2		ď	c	-	ć	i) 	ò	1
6077-X			י ב		٦ ,	າ ເ	0.K.	m	0.K.	S	YES	Ŋ	•
		•	2 1	۰ -	7 (.	0.K.	m	0.K.	S	YES	· C	VEC
		•	3.5	٠,	7 (m	0.K.	m	0.K.	S	YES	o es	7 7 7
		1	2	-	7	m	0.K.	3	0.K.	S	YES	ם	? .
301-177-C Dow Corning H-1	rning H	-	5	0	,	c	5	,	;				
XR-6-0	000		· <u>c</u>		۱ ۳	۰,	. i.	7)	0.K.	ח	•	Þ	•
)		2 4	,	7 (٦,	o.K.	m	0.K	n	•	=	,
		7.	9 5	.		ო	0.K.	٣	0.K.	- 11	•) =	1
		n	2	7	m	m	0.K.	3	0.K.) D		o =	• 1
301-177-D Dow Corning H-2	rning H	-2	2	0	2	_	2	c	;)	ı
XR-6-0	000		10	0	ო	٠,	, K	1 ~	, K	s :	YES	n :	
		~	رة ا	0	6	۳,	A	, (* :	> :	•	Þ	•
		5	0	0	, m	, "		າ ເ	o.ĸ.	D '		Ω	
					ı)	.4.0	n	o.k.	S	YES	n	•

Rating 0

Key to Numerical Ratings and Symbols	Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Key to Numerica	Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky

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Film Integrity

5

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

Recovery
4 Hour F
oce 5
Resistar
Lubricant
e and
Gasoline

U - Unaffected
S - Softened
D - Dissolved

P. Silicone Resins Cured with #2311 Experimental Silazane

- Many of the systems in this series gelled immediately after the addition of the silazane and were of no use.
- 2. Resistance to the test fluids was very poor.
- 3. Heat resistance was excellent.
- For details of silicone resins cured with #2311
 experimental silazane, see Table 27.

Q. Silicone Resins Cured with Z-6020 Amino Silane

- Some silicones do not react (or react very slowly)
 with Z-6020. All systems had a usable pot life.
- 2. Resistance to the test fluids was poor.
- 3. Heat resistance was good.
- For details of silicone resins cured with Z-6020, see Table 28.

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Table 27

Experimental Silazane (#2311) Catalyzed Silicone Resins	2 hr. @500F. MIL-S-3136 Fluid Lubricant Comments Adh. Film 4 hr. 24 hr. 4 hr. 24 hr. Comments Integrity Immers. Recovery Immers. Recovery	Immediate Gel	3 0.K. D		Immediate Gel	Immediate Gel	1 0.K, S NO S NO . 0 0.K, S NO S NO . 3 0.K, S NO S NO .	3 0.K, D - S NO - 3 0.K, S NO D -
			1 1 1	1 1 1	1 1 1	1 1 1	ON ON ON	ON I
	t hr Imme	1 1 1	Α.,	1 1 1		1 1 1	တ လ လ	ısa
	24 hr. Recovery			1 1 1	1 1 1		ON ON ON	ı i ON
e Resins	MIL-S-3 4 hr. Immers.		Α.,	111	1 1 1	1 1 1	တ လ လ	. Q S
d Silicon	G500F. Film ntegrity		0.K.	1 1 1	1 1 1	1 1 1	0.K. 0.K.	0.K. 0.K.
Catalyze	•l `	: 1 :	ო	1 1 1			3 0 1	ımm
e (#2311)	30 min. @500F. Adh. Film Integrity		0.K.	1 1 1	1 1 1	1 1 1	0 0 .K.	0.K. 0.K.
Silazan	30 min	1 1 1	m 1 1	1 1 1	1 1 1	1 1 1	ଜ୍ୟନ	ı m m
rperimental	Air Dried Film Dry Adhesion	1 1 1	רות א			1 1 1	m m 4	ı m 4
Experin		911	044	441			000	5 2 3
	Film Compatibility	U i i	ပပပ	ပပ၊			ပပပ	ပပပ
		95 90 85	95 90 85	95 90 85	95 90 85	95 90 85	95 90 85	95 90 85
	Silicone	SR-28	XR-261	SR-111	SR-98	SR-17	ST-847	DC-802
	Vehicle Code	301-98-A	301-98-B	301-98-C	301-98-D	301-98-E	301-98-F	301-98-G

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Table 27 (continued)

		Comments		1 1	ı	1 1	•			Immediate Gel		LITTLE REAC-	Little Reaction	Little Reaction		Little Reaction	le Reaction	ı			4	Inmediate Gel Inmediate Gel
	Libricant	24 hr.		l i	ı		•	,			1		- Litt	- Litt		- Little	- Little	•		•	,	
	,3	4 hr. Immers.	Ω	Ω Q	· -	9 0 1	a	ı		•	e	1	A i	a	ı	ı	ı	Ω	1)		•
	MIL-S-3136 Fluid	24 hr.	•	1 1	•	•	ı	•	ı	ı	•		•	ı				ı				1
ø	MIL-S-	4 hr. Immers.	Ω	<u>α</u> α	Q	96	•		•		Q	6	a c	•			ı	Q	1 1			1
Experimental Silazane (#2311) Catalyzed Silicone Resins	2 hr. @500F.	Integrity	0.K	0.K.	0.K.	0 0 K		,	•	1	0.K.	S	, X				ı	0.K.	1 1		•	1
lyzed S	2 hr.		e c	1 M	7	ന ന				ı	e	m	m		•			7 1	ı	ı	ı	1
2311) Cata	30 min. @500F.	Integrity	0.K.	0.K.	0.K	0.K		•	۱ ۱		0.K.	0.K.	0.K.		۱ ,		:	. c	•	ı	•	1
zane (#	30 mi		ი 2	7	7 5	1 7			,	r	า	٣	က	1		ı	·	4 1				
ental Sile	Air Dried Film Dry Adhesion		3 4	m	ი თ	7	•	•	,	~	r	۳,	4	,	,		m					
Experim	Air D	c	00	0	00	0		1		2	, ,	7 -	4	2	5	4	7	س م	n	ლ :	1	
•	Film Compatibility	c	, o c	, ر	ບບ	ပ	•		•	υ	(ن د	,	ပ	ပ (ی	υ	ບ ບ	,	υ _ι	•	
		95	8 %		288			8 :	င္စ	95	S	8 5		95	06 s	6	25	8 8	; ;	સ	85	
	Silicone Resin	DC-803	1	DC-8064		,	R-6-0031			SR-119				ST-856			XR-856		9	200-20		
	Vehicle Code	301-98-н		301-98-K			V-66-100			301-99-B			0 00	3-66-TOC			301-99-D		301-00-6	7-70-700		

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Table 27 (continued)

Experimental Silazane (#2311) Catalyzed Silicone Resins

Vehicle Code	Silicone		Film Compatibility	Air	Air Dried Film Dry Adhesion	30 min	30 min. @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	Lubr 4 hr. Immers.	Lubricant 24 hr. rs. Recovery	Comments
301-99-F	SR-32	95 85	1 1 1	1 1 1		1 1 1			111					Immediate Gel Immediate Gel Immediate Gel
301-99-C	XR- 630	95 85	ပပပ	000	ოოო	ოოო	0.K. 0.K.	ოოო	0.K.	000	1 1 1	လ လ လ	<u> </u>	
301-27-A	SR-82	95 90 85	ပပပ	000	888	3 2 2	0.K. 0.K.	3 5 5	0°K. 0°K.	999	1 1 1	000		
301-27-8	DC-840	95 90 85	υυυ	000	444	5 m m	0.K.	5 3 3	0 0 0 K	000	1 1 1	0 % 0	ON	
301-27-C	R- 64	95 90 85	υυυ	000	m 4 4	1 0	0.00 .K.	777	0.K.	900	1 1 1	200		
301-27-D	SR-120	95 90 85	ပပပ	m m 4	1 1 1	1 1 1	1 1 1	1 1 1	1 1 1		1 1 1		- Little - Little - Little	Little Reaction Little Reaction Little Reaction
301-27-E	R-4471	95 90 85	ပပပ	000	3 m m	2 1 2	0.K. 0.K.	7 7 7	0.K. 0.K.	999	111	999	1 1 1	

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	က	7	5

Compatibility

- C CompatibleH HazyI Incompatible

Film Integrity

- 0.K. No perceptible change except for darkening.
 B Blistered
- N.G. Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

Yes - Recovered original properties No - Did not recover original properties

U - Unaffected
S - Softened
D - Dissolved

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Table 28

				Amino	Amino Silane (2-6020) Catalyzed Silicone Resins	20) Catal	yzed Silico	ne Restr	SI				
Vehicle Code	Silicone Resin	29	Film Compatibility	Air I Dry	Air Dried Film Dry Adhesion	30 min.	30 min. @500F. Adh. Film Integrity	Adh.	Adh. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	Lubi 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-60-A	SR-28	99	ပပ	5.5		1 1		1 1	; ;	1 1			1 1
301-60-B	XR-261	96	ပပ	00	ოო	44	0.K.	6 4	0.K.	QQ	1 1	s D	o ,
301-60-C	SR-111	99 97	ပပ	r) en	1 m	ı 4	- 0.K.	١ 4	0.K.	ı vı	NO NO	ı»	0 Z
301-60-D	SR-98	99	υυ	00	3 1	3 4	0.K.	44	0.K.	99		99	
301-60-E	SR-17	96	ပပ	5 2	ıπ	- 7	- 0.K.	- 7	0.K.	ıω	ı O	ιω	ON
301-60-F	ST-847	99	ပပ	00	4 K	3 4	0.K.	3	0.K.	S S	ON	လ လ	ONO
301-60-6	DC-802	96	ပပ	εн	m 72	നന	0.K.	3	0.K	QΩ	YES	w w	o o o
301-60-н	DC-803	99 97	ပပ	00	നന	4 4	0.K.	7	0.K.	သ လ	NO NO	s s	NO NO
301-61-A	DC-806A	96	ပပ	00	3.2	ოო	0.K. 0.K.	ოო	0.K. 0.K.	00	, ,	တတ	ON ON
301-61-B	R-6-0031 99	1 99 97	ပပ	0 3	es es	e e	0.K. 0.K.	en en	0.K. 0.K.	s D	ON	O O	. •

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Table 28 (continued)

Vehfolo	7 7 7 6		ļ	Amino S	<u>ilane (2-60</u>	20) Catal	Amino Silane (2-6020) Catalyzed Silicone Resins	one Restr	81				
Code	Resin	ы	Film Compatibility	Air Dr.	Air Dried Film Dry Adhesion	30 min. @500F. Adh. Film Integrit	. @500F. Film Integrity	Adh.	2 hr. @500F. Adh. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	Lubi 4 hr.	Lubricant 24 hr.
301-61-0	SR-119	99	υu	'n	, ,	1 .		٠,		,	,	Times 8	RECOVETY
		: ;	,	>	7	4	0.K.	4	0.K.	Q	•	. 6	
301-61-0	ST-856	99	ပ ပ	00	നന	7 7	0.K	ന്ന	0.K	0.0	1	Ω :	1
301-61-E	XR-856	99	ပပ	ოი	en e	e .	0.K	, m	0.K.	a a	i i	ם ב	, ,
301-61-F	DC-805	00	Ç) i	n	4	0	4	0.K.	Q	ı	Ω	•
		97	ن ن	a m	. m	1 7	, O	۱ ۷	۵ ،	1 6	•	•	
301-61-6	SR-32	66	ပ	ı,	(t		a		တ	NO N
		26	υ	n m	· m	ı m	- 0.K.	, m) K	1 6	•	1 (• ;
301-61-н	XR-630	99	ပေး	0 (m	4	0.K.	_ m) K	a c	l :	n (O <u>v</u> !
301-62-4	60 80	; 8	, (5	7	4	0.K.	4	0.K.	20		n vs	2 2 2
B-10-100	70-WC	9,	ပပ	00	ო ო	44	0.K	44	0.K	Ω.	ŧ	D.	ı
301-62-B	DC-840	96	υu	00	m	4	0.K.	4	0.K.	a c		ء د	
301-62-C	B-64) (> (.	4	0.K.	ო	0.K.	Q		s o	. 2
	5	66	၁ပ	00	m m	44	0.K.	4 4	0.K.	0.5	•	Ω.	1
301-62-D	SR-120	66	ပ	2	,					•	ı	n	ON O
		26	ပ	'n	1			1	ı	r		•	•
							ı				•		

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Adnesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Hard	Hard	<pre>Tack-free but slightly soft</pre>	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	r r	2	æ	4	S

Compatibility

- C Compatible H Hazy
- I Incompatible

Film Integrity

- 0.K. No perceptible change except for darkening. B Blistered
- N.G. Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

R. Half Second RS Nitrocellulose Modification of Fluorinated Hydrocarbon Resins

- Compatibility of nitrocellulose and the fluorinated resins was good.
- The test fluid resistance of some of these systems was good.
- A few of these coatings decomposed during the heat test but most were satisfactory.
- 4. Details of nitrocellulose modification of fluorinated resins can be found in Table 29.

S. Polyvinyl Butyral Modification of Fluorinated Hydrocarbon Resins

- Compatibility of Bakelite XYHL and the fluorinated resins was poor.
- 2. Resistance to the test fluids was poor.
- 3. Heat Resistance was good.
- 4. For details of Bakelite XYHL modification of fluorinated hydrocarbon resins, see Table 30.

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Half Second RS Nitrocellulose Modification of Fluorinated Hydrocarbon Resins

Vehicle Code	Fluorinated Resin	2 Com	Film 7. Compatibility	Air Dr Dry	Air Dried Film Dry Adhesion	30 min. @500F. Adh. Film Integr	@500F. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubricant 4 hr. 24 hr. Immers. Recovery	Lubricant . 24 hr. rrs. Recovery
301-47-A Viton A	Viton A	90 75 50	###	0 0	64 3	നനന	0.K. 0.K.	332	0.0 0.K.	s n	YES	SSO	NO NO -
301-48-A	301-48-A Exon 461	90 75 50	ပပပ	000	444	4 0.1 3 0.1 DECOMPOSED	0.K. 0.K. osed	4 DECON	4 O.K. DECOMPOSED DECOMPOSED	0 0 0	1 1 1	9 9 9	1 1 1
301-49-A	301-49-A KEL-F Fluorel 90 75 50	el 90 75 50	* * *	000	404	4 4 E	0.K. 0.K.	3 5 DECON	3 0.K. 5 B DECOMPOSED	s s n	YES	n s	NO YES
301-50-A	301-50-A KEL-F 800	90 75 50	000	000	444	m 4 4	0.K. 0.K.	m m 4	0.K. 0.K.	s s D	NO YES	מממ	

Key to Numerical Ratings and Symbols

Adnesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky ,	Very tacky
Rating	0		2	m	4	S

Compatibility

C- Compatible

H- Hazy

I- Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U- Unaffected
S - Softened
D - Dissolved

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	Lubricant 4 hr. 24 hr. Immers. Recovery	S NO S		0N S	1 1 1
		, 0, 0,			
	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	YES	1 1 1	, , ON	1 1 1
n Resins	MIL-S- 4 hr. Immers	ı w w	. 00	1 1 W	1 1 1
drocarbo	(3500F. Film Integrity	0.K. 0.K.	0.K. 0.K.	0 K	1 1 1
rinated H	2 hr. @500F. Adh. Film Integrii	1 61 61	146	1 1 8	1 1 1
	30 min. @500F. Adh. Film	0.K.	0.K.	0. K.	1 1 1
	30 min.	ımm	1 47 60	2	1 1 1
	Akelite XYHL) Mc Air Dried Film Dry Adhesion	1 7 7	144	1 14	
	(Bakelit Air Dr Dry	100	.00	, , 0	1 1 t
	Polyvinyl Butyral (Bakelite XYHL) Modification of Fluctinated Control of Film Air Dried Film 30 min. @500F. 2 hr. @500F. 4 hr. Film Adh. Film 4 hr. 7 compatibility Dry Adhesion Adh. Integrity Immeri	нжж	ннн	 #	ннн
		90 75 50	90 75 50	rel 90 75 50	90 75 50
	Fluorinated Resin	Viton A	Exon 461	301-49-B KEL-F Fluorel 90 75 50	301-50-B KEL-F 800
	Vehicle Code	301-47-B Viton A	301-48-B Exon 461	301-49-B	301-50-B

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Po
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	m	4	5

Compatibility

C - CompatibleH - HazyI - Incompatible

Film Integrity

- 0.K. No perceptible change except for darkening.
 B Blistered
 N.G. Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected	S - Softened	D - Dissolved

24 Hour Recovery

T. Acryloid A-101 Modification of Fluorinated Hydrocarbon Resins

- Compatibility of Acryloid A-101 and the fluorinated resins was fairly good.
- Resistance to lubricant and MIL-S-3136 fluid was generally good.
- 3. Heat resistance was good.
- For details of Acryloid A-101 modification of fluorinated hydrocarbon resins, see Table 31.

U. Styrene Butadiene Modification of Fluorinated Hydrocarbon Resins

- Compatibility of Pliolite S-5 and the fluorinated resins was fair.
- 2. Resistance to the test fluids was poor.
- 3. Except for two systems, heat resistance was good.
- 4. For details of Pliolite S-5 modifications of fluorinated resins, see Table 32.

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Acrylic (Acryloid A-101) Modification of Fluorinated Hydrocarbon Resins

Vehicle Fluorinated 2 Gode Resin 2 301-47-D Viton A 90 301-48-D Exon 461 90 75 50 301-49-D KEL-F Fluorel 90 75 50 301-50-D KEL-F 800 90 75 50 75 50

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Sligntly tacky	Tacky	Very tacky
Rating	0	-	2	ည	7	S

Compatibility

C - Compatible
H - Hazy

I - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lutricant Resistance

U - Unaffected
S - Softened
D - Dissolved

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Styrene Butadiene (Pliolite S-5) Modification of Fluorinated Hydrocarbon Re

:	;		Figure Committee 3-3/ Modification of Fluorinated Hydrocarbon Resins	Tellie II	C-C antions	Modifi	cation of F	luorina	ted Hydrocar	oo Resi	su		
Vehicle	Fluorinated Resin		Film Compacibility	Air I	Air Dried Film Dry Adhesion	30 min	30 min, @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S- 4 hr. Immers	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lub 4 hr. Immers.	Lubricant 4 hr. 24 hr. Immers. Recovery
301-47-E	301-47-E Viton A	90 75 50	жжж	0 0	446	ოოო	0.K. 0.K.	ന ന ന	0.K. 0.K.	တလ	ON ON 1	מממ	
301-48-E	301-48-E Exon 461	90 75 50	UUU	000	ববব	0.3 3 0.1 DECOMPOSED	0.K. 0.K. POSED	4 DECON	4 O.K. DECOMPOSED DECOMPOSED	666	1 1 1	999	
301-49-E	301-49-E KEL-F Fluorel 90 75 50	11 90 75 50	## -	٥٥ ،	un saj d	νν.	0.K.	401	0.K. 0.K.	S S I	NO NO	n s	NO ;
301-50-E	301-50-E KEL-F 400	90 75 50	нн	0	1 1 4	ıım	0.K.	1 : 4	0.K.	1 1 00	, i ON	n	1 1 1

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	<pre>Tack-free but slightly soft</pre>	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	e	7	ĸΛ

Compatibility

- C Compatible H Hazy
- I Incompatible

Film Integrity

- 0.K. No perceptible change except for darkening.

 B Blistered

 N.G. Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

- U Unaffected
 S Softened
 D Dissolved

V. <u>Triazine Formaldehyde Modification of Fluorinated</u> <u>Hydrocarbon Resins</u>

- Compatibility of Uformite M-311 and the fluorinated hydrocarbon resins was fair.
- 2. Resistance to the test fluids was poor.
- 3. Heat resistance was good.
- For details of Uformite M-311 modification of fluorinated resins, see Table 33.

W. Polyvinyl Formal Modification of Fluorinated Hydrocarbon Resins

- Compatibility of Formvar 7/70 and the fluorinated resins was fair.
- 2. Resistance to the test fluids was poor.
- 3. Heat resistance was good.
- 4. Details of Formvar 7/70 modifications of fluorinated hydrocarbon resins may be found in Table 34.

Triazine Formaldehyde (Uformite M-311) Modification of Fluorinated Hydrocarbon Resins

Lubricant 4 hr. 24 hr. Immers. Recovery	1 1 1		ON I	1 1 1
Lub 4 hr. Immers.		999	ω ω ι	יממ
MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	, , OZ	1 1 1	NO NO	OZ I I
MIL-S-3 4 hr. Immers.	ŧ 1 ∞	000	က က ၊	S Q I
2 hr. @500F. Adh. Film Integrity	 0.K.	0.0 0.K.	0.K.	0.K.
2 hr.	114	4 W V	mm 1	46.1
30 min. @500F. Adh. Film Integrity	0.K.	0.K. 0.K.	0.K.	0.K.
30 mir	1 I M	4 Z E	ოო 1	441
Air Dried Film Dry Adhesion	114	44 4	44 I	4 4 1
Air D	110	000	001	001
Film Compatibility	ння	υжж	нжн	0 U H
	90 75 50	90 75 50	rel 90 75 50	90 75 50
Fluorinated Resin	Viton A	Exon 461	301-49-F KEL-F Fluorel 90 75 50	301-50-F KEL-F 800
Vehicle	301-47-F Viton A	301-48-F Exon 461	301-49-F	301-50-F

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	r.	2	က	4	S

Compatibility

- C CompatibleH HazyI Incompatible

Film Integrity

- 0.K. No perceptible change except for darkening.
 B Blistered
 N.G. Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

- U Unaffected
 S Softened
 D Dissolved

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Table 34

	uid Lubricant 4 hr. 24 hr.	, , , , ,	919	S S S	ON
Resins	MIL-S-3136 Fluid 4 hr. 24 hr. Immers, Recovery	S YES S NO S NO	0 1 0	S YES S YES S NO	S NO Q
inated Hydrocarbon	2 hr. @500F. Adh. Film Integrity	3 0.K. 3 0.K.	3 0.K.	3 3 3 0 0 K.	3 0.K.
Polyvinyl Formal (Formvar 7/70) Modification of Fluorinated Hydrocarbon Resins	30 min. @500F. Adh. Film Integrity	3 0.K. 3 0.K.	3 0.K. 6.	2 3 0.K.	3 0.K.
(Formvar 7/70) Mc	Air Dried Film Dry Adhesion	0 0 4 4 8	0:0	000	1 20 20
Polyvinyl Formal	Film Compatibility	= = =	o H H	ပပပ	нтт
	Fluorinated Resin Z	301-47-G Viton A 90 75 50	301-48-G Exon 461 90 75 50	301-49-G KEL-F Fluorel 90 75 50	301-50-G KEL-F 800 90 75 75 20
	Vehicle Code	301-47-G	301-48-6	301-49-6	301-50-G

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Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	က	7	5

Compatibility

C - CompatibleH - HazyI - Incompatible

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

X. Miscellaneous Resin Systems

- Many of the miscellaneous resin systems tested showed great promise in the initial screening tests. Most of the better coatings were based on epoxies, polyurethanes, or polyesters.
- For results of testing the miscellaneous resin systems, see Table 35.

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		W	scella	neous R	Miscellaneous Resin Systems	tems						
Vehicle Code	Type of Resin	Air Dried Film Dry Adhesion	, .,	30 min. Adh.	30 min. @500F. Adh. Film Integrity	Adh.	@500F. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubi 4 hr. Immers.	Lubricant 24 hr. rs. Recovery	Comments
301-28-A	90% Midland R62 10% ½" RS N.C. 75% Midland R62 25% ½" RS N.C. 50% Midland R62 50% ½" RS N.C.	000	m - 1 - 1	777	в В О.К.	777	в 0.К	aso	NO I	s s n	ON O	
301-28-в	90% Midland R62 10% ½" SS N.C. 75% Midland R62 25% ½" SS N.C. 50% Midland R62 50% ½" SS N.C.	1 0 0	01 01 -1	777	ммм	777	មាយស	SD	, 8, ,	လလလ	0 0 0	
301-28-C	90% Midland R62 10% Acryloid A-101 75% Midland R62 25% Acryloid A-101 50% Midland R62 50% Acryloid A-101	- 1	+	1 1 4	o.k.	1 1 4	 0.K.	ι ι ω	ı ı ON	115		Incompatible Incompatible
301-28-D	90% Midland R62 10% ½" CAB 75% Midland R62 25% ½" CAB 50% Midland R62 50% ½" CAB	0 0 3 3	m m .+	ოოო	0 0	m m m	0.K.	SSD	ON I	လ လ လ	NO NO YES	
301-55-F	Spenkel XP-1078 Polyurethane	0 0		4 (0.K.	DECON	DECOMPOSED	S	YES	n	•	1
301-55-6	KOSKYGOL FOLYESTER 63% XR-6-0031: 90% Multron R-16: 28% Mondur CB-75		n m	r 2	0.K	5 3	0.K.	n s	YES	ם ם	e e	
301-78-N	Paraplex P-444A Polyester	2 0	0	0	0.K.	, ,	0.K.	S	ON	ß	NO	٠
301-242-A 301-242-B	301-242-A 95% Midland X-4323 5% DET 301-242-B 90% Midland X-4323 10% DET	3 2 4	QI QI	m m	0.K.	4 4	0.K.	s s	YES	s n	ON I	Very Brittle Very Brittle

Table 35 (continued)

Miscellaneous Resin Systems

				all cours	STREET OF THE STREET	ומ						
Vehicle Code	Type of Resin	Air D Dry	Air Dried Film Dry Adhesion	30 min	30 min. @500F. Adh. Film	2 hr.	2 hr. @500F. Adh. Film	MIL-S-3		4 hr	Lubricant 24 hr.	Comments
				-11	THERETEN	٦,	Integrity	Immers.	Recovery	Immers.	Recovery	
301-242-C	301-242-C 85% Midland X-4323 15% DET	4	7	ю	0.K.	4	0.K.	S	YES	n	,	Verv Rrittle
301-242-D	301-242-D 75% Midland X-4323 25% Versamid 11	.15 1	2	1	0.K.	1	О.К.	Q	ı	n	, ,	Vory Briteil
301-242-E	50% Midland X-4323 50% Versamid 11	.15 2	2	7	0.K.	1	0.K.	Ω			• •	Very Briteil
301-330-A	52% Midland X-4323:48% Mondur CB-7	75 0	0	ı	•	1	ı	n		n	- Slie	Slightly Brittle
301-330-B	301-330-B 40% X-4323: 33% Mondur CB-75: 27% Multron R-16	0	4	ı	•	ı	,	w	YES	b	•	
301-330-C	25% X-4323:	0	е	1	ı	•	ı	S	YES	S	ON ON	
301-330-D	12% X-4323: 18% Mondur CB-75: 70% Multron R-16	m	e	ı	ı	ı	1	S	ON	တ	ON	•
301-330-E	48% Midland X-4323; 52% Midland X-3934	1	0	. '	ı	1	ı	s	YES	Ω	•	•
301-330-F	45% Midland X-4323; 55% Midland X-3934	0	0	ı	ı	1	·	S	YES	Ω		,
301-330-G	43% Midland X-4323; 57% Midland X-3934	0	0	ı	ı	1	ı	S	YES	D	,	1
301-350-A	Enjay Buton 300	0	5	1	1		•	S	YES	=	j.	0 4 4 4 5 1 G
301-407-A	301-407-A Polylite 8703 Polyester	0	4	,	•		,	. =)	· =		very brittle
301-407-B	301-407-B Polylite 8702 Polyester	0	4		•		1	n		· =		Very brittle
301-407-C	50% Polylite 8702: 50% Polylite 8703	0	4	•	ı		1	n	t) b	V	very brittle Very Brittle

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Table 35 (continued)

		1

:		Misc	Miscellaneous Resin Systems	Systems					
Code	Type of Resin - Air Dry	Air Dried Film Dry Adhesion	30 min. @500F. Adh. Film Integrity	2 ltr. @500F. Adn. Film Integrity		MIL-S-3136 Fluid 4 hr. 24 hr.		Lubricant hr. 24 hr.	Comments
301-428-A	301-428-A Phenoxy Siloxane	H				vecovery		Immers. Kecovery	
301-245-A	301-245-A 57% Oxiron 2000: 38% PMDA Adduct a o	•	,	ı	n	Q N	w	0 <u>0</u>	Brittle
	5% Resimene 882	1	1 0.K.	1 0.K	n	•	ם	•	
30.1-245-B	60% Oxiron 2000: 40% PMDA Adduct A 0	1	1 0.K.	1 0.K.	n		1		
301-428-B	75% Dow Corning XR-6-0000; 0 25% Dow Corning XZ-2-2023	2	•	,	Ω	•	n	- Slig	Slightly Brittle
301-428-C	301-428-c 70% Oxiron 2000: 30% XZ-2-2023 5	•	•						
301-428-D	50% Epon 1007: 50% XZ-2-2023 2	-	' '	' '	1	ı	1	ı	•
301-434-A	50% Arofilint 202-XA1-60:	-	1	1	b	ı	U	1	
301-434-B	50% 303-X-90 40% Aroflint 202-XAI-60:	٠.	' '		S	YES	Ω	- Slight	- Slightly Brittle
301-244-1		→	,	1	S	YES	n		1
	caryiii #1439 Vietnane	2	1 0.K.	0 0.K.	s	YES	n	4	•

Key to Numerical Ratings and Symbols

Adhesion Excellent	Very good	poog	Fair	Poor	Extremely Poor
<u>Dry</u> Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	o 1	7	æ	4	5

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

74 Hour Recovery	•
Gasoline and Lubricant Resistance	

U - Unaffected
S - Softened
D - Dissolved

Yes - Recovered original properties No - Did not recover original properties

Section IV

Development of Primer

A. Initial Vehicles Used

After the screening tests had been completed on the clear resin systems, the test results were reviewed and the following vehicles were chosen for use in primers:

- 50% Midland R-62
 50% Half Second RS Nitrocellulose
- 2. 50% Dow Corning R-6-0031 50% Half Second RS Nitrocellulose
- 50% Plaskon ST-856
 50% Half Second RS Nitrocellulose
- 4. 50% Dow Corning DC-803
 50% Half Second Cellulose Acetate Butyrate
- 50% Dow Corning DC-805
 50% Half Second Cellulose Acetate Butyrate
- 50% General Electric SR-82
 50% Formwar 7/70
- 7. 50% Kel F 800 50% Acryloid A-101
- 8. 75% Kel F Fluorel25% Acryloid A-101

- 9. 50% Dow Corning R-6-0031 50% Bakelite BRS-2600
- 10. 25% Plaskon ST-847
 75% Midland R-55
- 11. Roskydol 500 Catalyzed Polyester
- 73% Dow Corning R-6-00315% Mobay Multron R-1622% Mobay Mondur CB-75
- 13. 90% Epon 100910% Versamid 115
- 14. 90% Epon 100910% Dow Corning Z-6020
- 15. Epon 1009 catalyzed with diethylene triamine (DET).
- 16. 75% Epon 100125% Versamid 115
- 17. 90% Epon 100110% Dow Corning Z-6020
- 18. Epon 1001 catalyzed with diethylene triamine (DET).
- 75% Dow Corning XR-6-0000
 25% Versamid 115

- 75% Midland X-4209
 25% Versamid 115
- 21. 75% Dow Corning XR-6-0000 25% Dow Corning Z-6020
- 75% Midland X-420925% Dow Corning Z-6020

It will be noted that several vehicles which appear in Table 35 and seem to have some promise are not included in this list. These materials were evaluated later in the contract and will be mentioned later in the report.

B. Pigments Used

Previous work to develop a coating system for magnesium included an extensive evaluation of corrosion inhibiting pigments. It was determined that the chromates of calcium and strontium were among the most effective for protection of magnesium. These pigments were selected for the primers. Zinc chromate was believed worthy of testing and was also included.

The same previous work² found a pigment content of 35% by weight to provide the optimum protection of magnesium.

This pigment content was chosen for the initial pigment study. No extender pigments were used.

- The reference may be found in the bibliography section of the appendix.
- 2. Ibid.

C. Bimetallic Corrosion Testing

It was decided to form a bimetallic couple between the coated magnesium panel and 17-7PH stainless steel to test the effectiveness of the coatings in preventing galvanic corrosion. The coated magnesium panel and the stainless steel strip were mounted approximately 1 inch apart in a wooden mounting block and were then connected with a copper wire and clips. The magnesium panel was scraped with a knife to bare metal where the clip was attached. (See fig. 1)

Initially, some panels had been coated with 0.0005, 0.0010, and 0.0015 inches of two of the primers. The panels were connected to the stainless steel and immersed in 1 and 5% NaCl solutions which were contained in 1 gallon glass jars. The panels were immersed to a depth of 4 inches and the immersed anode: cathode area ratio was 4:1 (See fig. 2). A number of materials were used to cover the uncoated edges of the panels. It was found that black electrical tape put on the edges of the panel and coated with a layer of paraffin afforded the best protection. It was also determined that a coating thickness of 0.0015 inches and an electrolyte concentration of 1% NaCl produced the most consistent results. All coatings were tested for bimetallic corrosion resistance in this manner. Table 36 explains the symbols used in rating bimetallic corrosion.

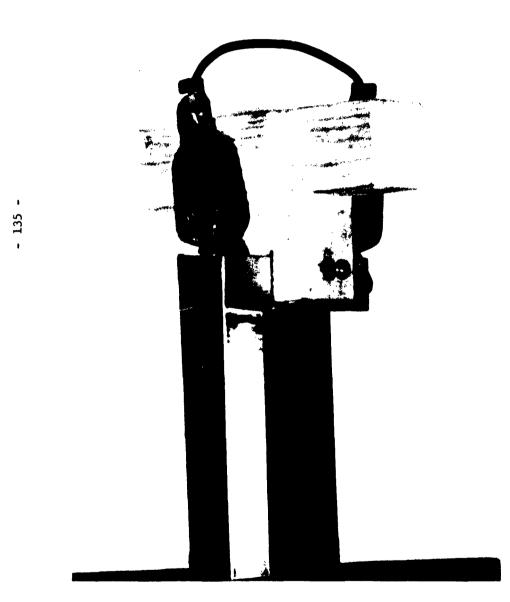


Fig. 1

MOUNTING OF BIMETALLIC CORROSION TEST PANELS

FIG. 2

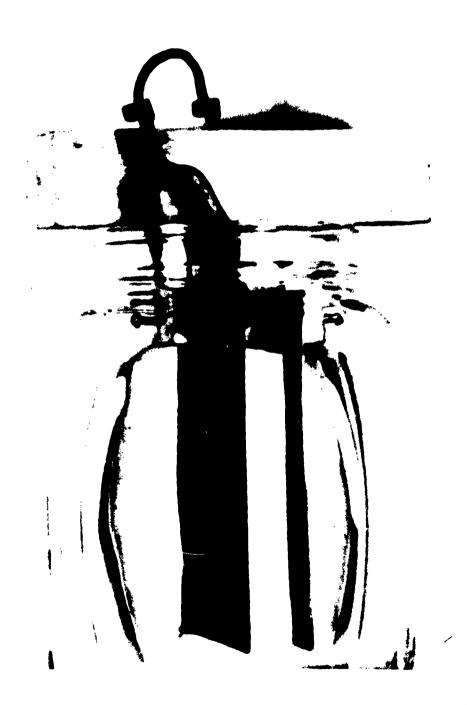


Fig. 2
BIMETALLIC CORROSION TEST CELL

Table 36

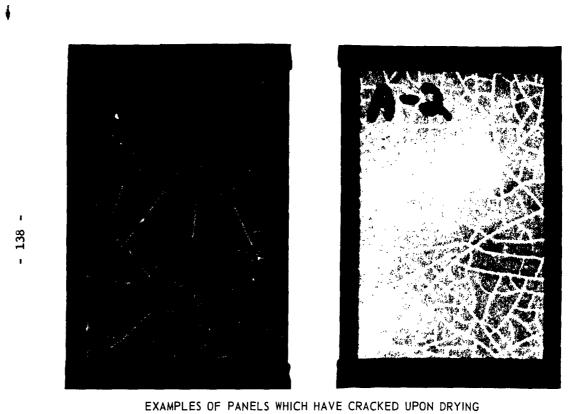
Bimetallic Corrosion Rating System

The following ratings are used in all bimetallic corrosion tables:

Rating	Hours Exposed	Condition of Panel
0	500	Perfect.
1	500	Very few very small blisters or slight discoloration.
2	500	Many small blisters and few medium blisters. Very slight corrosion.
3	500	Many small and medium blisters. Few large blisters and slight corrosion.
4	Less than 500	Many blisters and considerable corrosion.
5	Less than 500	Many blisters and severe corrosion.

The following symbols may also be found:

- N.T. The coating was not tested due to some film failure such as cracking. (See fig. 3)
 - G The coating gelled during preparation and could not be tested.



D. Results of Bimetallic Corrosion Testing

As a result of the galvanic corrosion tests, the following primers were selected for further testing:

- 1. 301-103-A
- 2. 301-101-D
- 3. 301-131-B

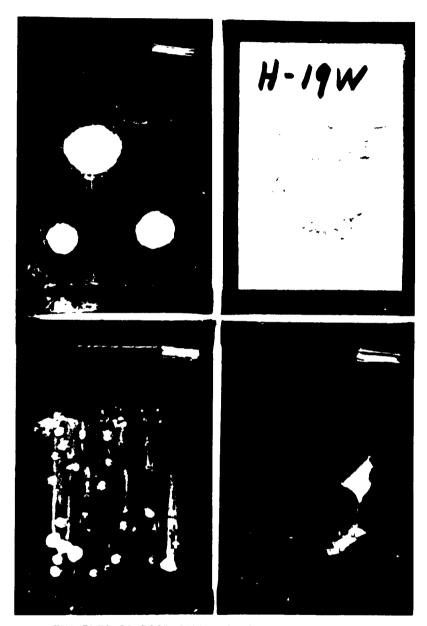
The results of galvanic corrosion testing of the primers may be found in Table 37.

E. Addition of Inert Pigments to Primers

Most of the failures which occurred during the galvanic corrosion testing of the primers were due to blistering and/or corrosion. (See fig. 4) It was decided to evaluate the addition of extender pigments to these coatings in an attempt to reduce the blistering. The inert pigments used were talc and clay. The total pigment content was kept at 35% by weight.

It was found that no improvement was made in the performance of the topcoats tested but rather the galvanic corrosion resistance of the coatings containing the extender pigments was worse than that of the original coatings. (See fig. 5) For results of galvanic corrosion testing of primers containing extender pigments, see Table 38.

FIG. 4

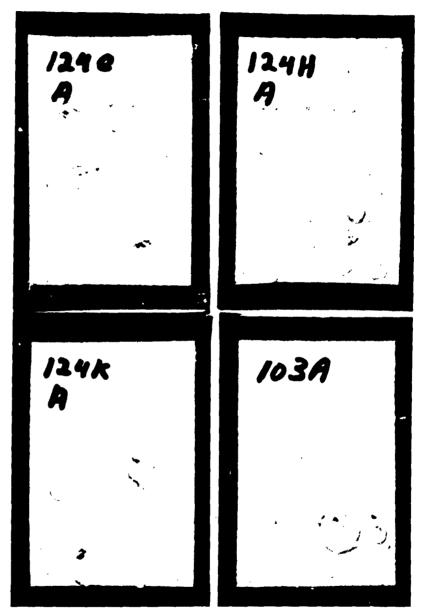


EXAMPLES OF POOR GALVANIC CORROSION RESISTANCE ALL FAILED IN LESS THAN 500 HOURS

Fig. 4

TYPICAL GALVANIC CORROSION FAILURES

FIG. 5



RESULTS OF ADDING INERT PIGMENTS TO PRIMERS ALONE 124G, H, K-INERTS 300 HRS. IN CELL, 103A-NONE 500 HRS.

Fig. 5

GALVANIC CORROSION TESTING OF PRIMERS

CONTAINING EXTENDER PIGMENTS

Table 37

Bimetallic Corrosion Testing of Primers

Rating	400	พหาด	יט יט יט	יט יט יט	644	מ יט יט	X X X Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y Y
Pigment	Zinc Chromate Strontium Chromate Calcium Chromate	Zinc Chromate Strontium Chromate Calcium Chromate	Zinc Chromate Strontium Chromate Calcium Chromate	Zinc Chromate Strontium Chromate Calcium Chromate	Zinc Chromate Strontium Chromate Calcium Chromate	Zinc Chromate Strontium Chromate Calcium Chromate	Zinc Chromate Strontium Chromate Calcium Chromate
Primer Vehicle	Midland R-62: ½" Nitrocellulose Midland R-62: ½" Nitrocellulose Midland R-62: ½" Nitrocellulose	Dow Corning R-6-0031: 4" Nitrocellulose Dow Corning R-6-0031: 4" Nitrocellulose Dow Corning R-6-0031: 4" Nitrocellulose	Plaskon ST-856: 놯" Nitrocellulose Plaskon ST-856: 놯" Nitrocellulose Plaskon ST-856: 扌" Nitrocellulose	DC-803: ½" CAB DC-803: ½" CAB DC-803: ½" CAB	DC-805: ½" CAB DC-805: ½" CAB DC-805: ½" CAB	General Electric SR-82: Formvar 7/70 General Electric SR-82: Formvar 7/70 General Electric SR-82: Formvar 7/70	<pre>Kel-F 800: Acryloid A-101 Kel-F 800: Acryloid A-101 Kel-F 800: Acryloid A-101</pre>
Primer Code	301-100-A 301-100-B 301-100-C	301-100-D 301-100-E 301-100-F	301-100-G 301-100-H 301-100-K	301-101-A 301-101-B 301-101-C	301-101-D 301-101-E 301-101-F	301-101-G 301-101-H 301-101-K	301-102-A 301-102-B 301-102-C

Table 37 (continued)

Bimetallic Corrosion Testing of Primers

400	3	יי ייט עי	ୀ ପଳସ	ነ ທທ	ን 4 ኮሞ	י יטיטיר	า เกษ
Pigment	Zinc Chromate	Zinc Chromate	Zinc Chromate	Zinc Chromate	Zinc Chromate	Zinc Chromate	Zinc Chromate
	Strontium Chromate	Strontium Chromate	Strontium Chromate	Strontium Chromate	Strontium Chromate	Strontium Chromate	Strontium Chromate
	Calcium Chromate	Calcium Chromate	Calcium Chromate	Calcium Chromate	Calcium Chromate	Calcium Chromate	Calcium Chromate
Primer Vehicle	Kel-F Fluorel: Acryloid A-101	Dow Corning R-6-0031; Bakelite BRS-2600	Midland R-55: Plaskon ST-847	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Epon 1001: Versamid 115	Epon 1001: Dow Corning Z-6020	Epon 1001: Diethylene Triamine (DET)
	Kel-F Fluorel: Acryloid A-101	Dow Corning R-6-0031; Bakelite BRS-2600	Midland R-55: Plaskon ST-847	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Epon 1001: Versamid 115	Epon 1001: Dow Corning Z-6020	Epon 1001: Diethylene Triamine (DET)
	Kel-F Fluorel: Acryloid A-101	Dow Corning R-6-0031; Bakelite BRS-2600	Midland R-55: Plaskon ST-847	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Epon 1001: Versamid 115	Epon 1001: Dow Corning Z-6020	Epon 1001: Diethylene Triamine (DET)
Primer	301-102-D	301-102-G	301-103-A	301-104-A	301-106-A	301-106-B	301-106-C
	301-102-E	301-102-H	301-103-B	301-104-B	301-106-D	301-106-E	301-106-F
	301-102-F	301-102-K	301-103-C	301-104-C	301-106-G	301-106-H	301-106-K

Table 37 (continued)

Bimetallic Corrosion Testing of Primers

	TIMES OF THE STATE	C Toll	
Primer	Primer Vehicle	Pigment	Rating
301-107-A	Epon 1009: Versamid 115	Zinc Chromate	w 24
301-107-D	Epon 1009: Versamid 115	Strontium Chromate	
301-107-G	Epon 1009: Versamid 115	Calcium Chromate	
301-107-B	Epon 1009: Dow Corning Z-6020	Zinc Chromate	איטיט
301-107-E	Epon 1009: Dow Corning Z-6020	Strontium Chromate	
301-107-H	Epon 1009: Dow Corning Z-6020	Calcium Chromate	
301-107-C	Epon 1009: Diethylene Triamine (DET)	Zinc Chromate	N N 4
301-107-F	Epon 1009: Diethylene Triamine (DET)	Strontium Chromate	
301-107-K	Epon 1009: Diethylene Triamine (DET)	Calcium Chromate	
301-103-D	Roskydol 500	Zinc Chromate	७ ७ ७
301-103-E	Roskydol 500	Strontium Chromate	
301-103-F	Roskydol 500	Calcium Chromate	
301-125-A	Midland X-4209: Versamid 115	Zinc Chromate	וע יעי
301-125-C	Midland X-4209: Versamid 115	Strontium Chromate	
301-125-E	Midland X-4209: Versamid 115	Calcium Chromate	
301-125-B	Midland X-4209: Dow Corning Z-5020	Zinc Chromate	<u>ሊ</u> የ/ የ/
301-125-D	Midland X-4209: Dow Corning Z-5020	Strontium Chromate	
301-125-F	Midland X-4209: Dow Corning Z-6020	Calcium Chromate	
301-125-G 301-125-K 301-131-B 301-125-H 301-131-A 301-131-C	Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Dow Corning 2-6020	Zinc Chromate Strontium Chromate Calcium Chromate Zinc Chromate Strontium Chromate Calcium Chromate	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	500	500	Less than 500	Less than 500
Rating	0	1	8	೮	7	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 38

Bimetallic Corrosion Testing of Primers Containing Extender Pigments

	9		
Primer Code	Primer Vehicle	Pigment Composition	Rating
301-100-D 301-123-G	Dow Corning R-6-0031; ½" Nitrocellulose Dow Corning R-6-0031; ½" Nitrocellulose	100% Zinc Chromate (87% Zinc Chromate (8% Talc (5% Clay	ν. ₁ ν.
301-100-E 301-123-H	Dow Corning R-6-0031: ½" Nitrocellulose Dow Corning R-6-0031: ½" Nitrocellulose	100% Strontium Chromate (87% Strontium Chromate (8% Talc (5% Clay	ν , ν
301-100-F 301-123-K	Dow Corning R-6-0031: ½" Nitrocellulose Dow Corning R-6-0031: ½" Nitrocellulose	100% Calcium Chromate (87% Calcium Chromate (8% Talc (5% Clay	יט אט
301-101-D 301-124-A	Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB	100% Zinc Chromate (87% Zinc Chromate (8% Talc (5% Clay	m 4
301-101-E 301-124-B	Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB	100% Strontium Chromate (8/% Strontium Chromate (8% Talc (5% Clay	4 2
301-101-F 301-124-C	Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB	100% Calcium Chromate (87% Calcium Chromate (8% Talc (5% Clay	4.8

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Table 38 (continued)

Bimetallic Corrosion Testing of Primers Containing Extender Pigments

Primer Code	Primer Vehicle	Pigment Composition	Rating
301-103-A 301-124-G	Midland R-55: Plaskon ST-847 Midland R-55: Plaskon ST-847	100% Zinc Chromate (87% Zinc Chromate (8% Talc (5% Clay	7 4
301-124-н	Midland R-55: Plaskon ST-847	(74% Zinc Chromate (16% Talc (10% Clay	4
301-124-K	Midland R-55: Plaskon ST-847	(61% Zinc Cnromate (24% Talc (15% Clay	4

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	. 009	500	500	200	Less than 500	Less than 500
Rating	0	1	2	۳	4	2

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

F. Salt Spray Exposure of Primers

Panels coated with the initial primers were tested in 5% salt spray at the same time they were being evaluated for galvanic corrosion resistance. Throughout most of the contract, this simultaneous exposure was conducted. The coating thickness on the salt spray panels was the same as the bimetallic corrosion panels. All salt spray panels were scribed to the bare metal down the center of the panel. For results of salt spray exposure of the primers, see Tables 39 and 40. (See fig. 6)

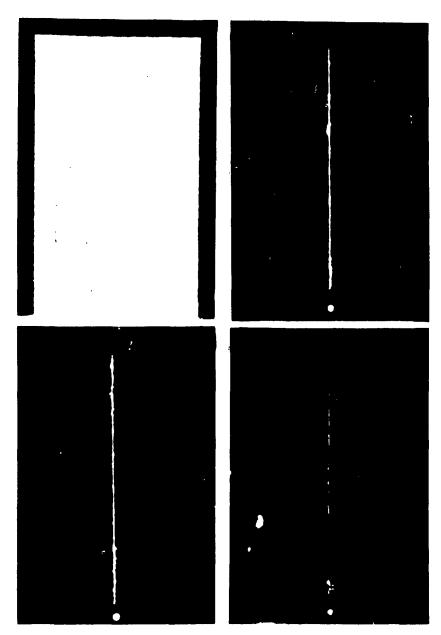
It should be noted that all salt spray results, unless otherwise stated, represent the entire panel, not only the scribed portion of the panel. When different results occur on the panel and on the scribe, a semicolon is used. For example:

Many small blisters; many small blisters, slight corrosion on scribe.

indicates the following were present:

- (1) many small blisters on panel.
- (2) many small blisters on scribe.
- (3) slight corrosion on scribe.

FIG. 6



VARYING RESULTS IN 5% SALT SPRAY. PERFECT IN UPPER LEFT, TO MANY BLISTERS LOWER RIGHT

Fig. 6

TYPICAL 5% SALT SPRAY TEST RESULTS

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Table 39

5% Salt Spray Testing of Primers

Primer Code	Results	Hours
301-100-A	One large and some small blisters, cracking and lifting	800
301-100-B	One medium blister, some fading, slight corrosion	1600
301-100-C	Severe blistering	1400
301-100-D	Many blisters, some cracking and peeling	200
301-100-E	Some medium blisters, slight lifting and fading	1400
301-100-F	Some small blisters, slight lifting, cracking, and corrosion	1000
301-100-G	Severe blistering	400
301-100-H	Some medium and large blisters, some fading	800
301-100-K	Few medium blisters, some lifting and corrosion	2000
301-101-A 301-101-B 301-101-C	Severe blistering, slight lifting Some small blisters, some lifting and fading Severe blistering	800 1600 1200
301-101-D 301-101-E 301-101-F	Severe blistering, slignt lifting Many small blisters Some small and very few medium blisters, some lifting	1400 200 1200
301-101-G	Severe blistering	200
301-101-H	Many small blisters, some corrosion	400
301-101-K	Many blisters	200
301-102-D	Many small and some medium blisters, some corrosion	400
301-102-E	Some very small blisters; slight corrosion on scribe	2000
301-102-F	Many very small blisters	2000

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Table 39 (continued)

5% Salt Spray Testing of Primers

Hours	007 007	2000 2000 2000	600 800 2000	200 1000 2000	600 2000 2000	1200 1400 600	600 800 1400
Results	Some small blisters, slight corrosion	Completely unaffected	Many very small blisters	Many blisters	Some very small blisters; some corrosion on scribe	Severe fading; some corrosion on scribe	Many small blisters, slight corrosion
	Some small blisters, many water spots	Completely unaffected	Many very small blisters	Many blisters	Some fading	Three medium blisters, slight corrosion, completely faded	Severe blistering and fading
	Some very small blisters, many water spots	Completely unaffected	Few very small blisters	Completely unaffected	Completely unaffected	Many small and one medium blister	Some blistering
Primer Code	301-102-G	301-103-A	301-104-A	301-106-A	301-106-B	301-106-C	301-107-A
	301-102-H	301-103-B	301-104-B	301-106-D	301-106-E	301-106-F	301-107-D
	301-102-K	301-103-C	301-104-C	301-106-G	301-106-H	301-106-K	301-107-G

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Table 39 (continued)

5% Salt Spray Testing of Primers

Primer Code	Results	Hours Tested
301-107-B	Many small blisters; slight corrosion on scribe	600
301-107-E	Few small blisters, slight corrosion and fading	1000
301-107-H	Few small and very small blisters	800
301-107-c	Few small and medium blisters; slight corrosion on scribe	1000
301-107-F	Severe blistering and fading	600
301-107-K	Many small blisters	1400
301-125-A	Very slight corrosion	2000
301-125-C	Few small blisters, slight lifting and fading	2000
301-125-E	Few very small blisters, many very small blisters on scribe	2000
301-125-B	Severe blistering	600
301-125-D	Many small blisters, slight lifting and corrosion	1600
301-125-F	Few very small blisters on scribe; some fading	2000
301-125-G 301-125-K 301-131-B	Many small blisters Many small blisters Some small blisters	600 600 2000
301-125-H	Few very small blisters, very slight lifting	2000
301-131-A	Some small blisters, slight lifting and corrosion	2000
301-131-C	Slight corrosion on scribe	2000

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Table 40

	5% Salt Spray Testing of Primers Containing Extender Pigments	
Primer Code	Results	Hours Tested
301-100-D 301-123-G	Many blisters, some cracking and peeling Not Tested	200
301-100-E 301-123-H	Some medium blisters, slight lifting and fading Not Tested	1400
301-100-F 301-123-K	Some small blisters, slight lifting, cracking, and corrosion Not Tested	1000
301-101-D 301-124-A	Severe blistering, slight lifting Severe blistering	1400
301-101-E 301-124-B	Many small blisters Severe blistering	200 400
301-101-F 301-124-C	Some small and very few medium blisters, some lifting Many small blisters	1200
301-103-A 301-124-G 301-124-H 301-124-K	Completely unaffected Completely unaffected Completely unaffected Completely unaffected	2000 2000 2000 2000

Section V

Development of Olive Drab Topcoat

A. Initial Vehicles Used

The vehicles used for preparation of olive drab topcoats
were the same as those used for the primers. The complete
list can be found in part A of the primer section.

B. Pigmentation

The following pigmentation was used to obtain the #2430 olive drab color and 15-25° gloss:

Pigment	% by weight
Medium chrome yellow	31.6
Red lead	16.7
Zinc oxide	9.1
Red iron oxide	12.3
Lampblack	6.0
Titanium dioxide	10.9
Clay	2.7
Diatomaceous earth	10.7
	100.0%

Coatings containing unmodified silicone resins did not include the red lead because of the reactivity of those resins with lead. A pigment content of 65% by weight was used. No attempt was made to shade these coatings to match the #2430 color chip nor was the gloss of any coating adjusted.

C. Preparation of Panels

The Dow 17 treated HK-31 magnesium panels were primed with 0.0015 inches of primer and allowed to age a minimum of 7 days. The same thickness of topcoat was applied and the panels were aged for 7 more daysbefore testing. Each coating was crosshatched with a stylus and the adhesion tested with cellulose tape. The tape was firmly applied to the crosshatched section and then removed from the panel in one rapid motion. See Table 41 for adhesion rating key. (See fig. 7)

D. Bimetallic Corrosion and Salt Spray Testing

The bimetallic corrosion and salt spray testing of the complete coating systems were conducted in the same manner as those tests were performed on the primers alone.

The following systems were judged to be the best coatings at this point in the work:

	Primer	Topcoat
1.	301-103-A	301-115-A
2.	301-131-B	301-115-A
3.	301-131-B	301-114-C
4.	301-103-A	301-134-A
5.	301-103-A	301-134-C
6.	301-131-B	301-134-C
7.	301-131-B	301-118-F

For results of salt spray and bimetallic corrosion testing of the olive drab coating systems, see Tables 42 and 43.

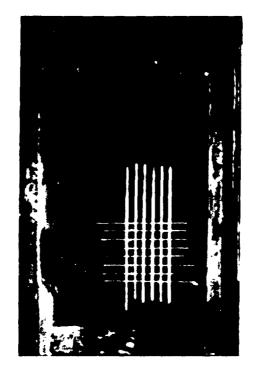




Fig. 7

EXAMPLES OF GOOD AND POOR ADHESION

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Table 41

Adhesion Rating System

In all complete coating systems (primer plus topcoat), the coating was crosshatched to bare metal and the adhesion was tested with cellulose tape. The tape was firmly applied to the crosshatched section and then removed from the panel in one rapid motion. The following rating system was used:

Rating	Description	Rating	Description
0	Excellent Adnesion	0	Excellent Adhesion
1	Less than 10% failure, topcoat from primer	11	Less than 10% failure, primer from substrate
7	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
m	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4 7	50-75% failure, primer from substrate
S	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

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Table 42

	Rating	N. T. o	N. T. 5	N. T. 4 4	N.T.	W 4 W	e K. Y. e	N. Y. N. T.	v
Bimetallic Corrosion Testing of Olive Drab Coating Systems	Topcoat Vehicle	Midland R-62: ½" RS Nitrocellulose Midland R-62: ½" RS Nitrocellulose Midland R-62: ½" RS Nitrocellulose	Dow Corning R-6-0031: ½" RS Nitrocellulose Dow Corning R-6-0031: ½" RS Nitrocellulose Dow Corning R-6-0031: ½" RS Nitrocellulose	Plaskon ST-856: ½" RS Nitrocellulose Plaskon ST-856: ½" RS Nitrocellulose Plaskon ST-856: ½" RS Nitrocellulose	Dow Corning DC-803: ½" CAB Bow Corning DC-803: ½" CAB Dow Corning DC-803: ½" CAB	Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB	General Electric SR-82: Formvar 7/70 General Electric SR-52: Formvar 7/70 General Electric SR-62: Formvar 7/70	<pre>Kel-F 800: Acryloid A-101 Kel-F 800: Acryloid A-101 Kel-F 800: Acryloid A-101</pre>	Kel-F Fluorel: Acryloid A-101
	Topcoat Code	301-112-A 301-112-A 301-112-A	301-112-B 301-112-B 301-112-B	301-112-C 301-112-C 301-112-C	301-113-A 301-113-A 301-113-A	301-113-B 301-113-B 301-113-B	301-113-C 301-113-C 301-113-C	301-114-A 301-114-A 301-114-A	301-114-B
	Primer Code	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-E	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	;

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Table 42 (continued)

	Rating	ლ ა ⊓	2 2 1	ၒ	222	222	ጠፋላ	244	8 10 8
Bimetallic Corrosion Testing of Olive Drab Coating Systems	Topcoat Vehicle	Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600	Midland R-55: Plaskon ST-847 Midland R-55: Plaskon ST-847 Midland R-55: Plaskon ST-847	Roskydol 500	Epon 1001: Versamid 115 Epon 1001: Versamid 115 Epon 1001: Versamid 115	Epon 1001: Dow Corning Z-6020 Epon 1001: Dow Corning Z-6020 Epon 1001: Dow Corning Z-6020	Epon 1001: Diethylene Triamine (DET) Epon 1001: Diethylene Triamine (DET) Epon 1001: Diethylene Triamine (DET)	Epon 1009: Versamid 115 Epon 1009: Versamid 115 Epon 1009: Versamid 115	Epon 1009: Dow Corning Z-6020 Epon 1009: Dow Corning Z-6020 Epon 1009: Dow Corning Z-6020
	Topcoat Code	301-114-C 301-114-C 301-114-C	301-115-A 301-115-A 301-115-A	301-115-B	301-117-A 301-117-A 301-117-A	301-117-B 301-117-B 301-117-B	301-117-C 301-117-C 301-117-C	301-117-D 301-117-D 301-117-D	301-117-E 301-117-E 301-117-E
	Primer Code	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	:	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B

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Table 42 (continued)

	4	3 3 5	n 100	, N. T.	7 886	ላ 4ኒሳ	2 2 0 0 1.
Bimetallic Corrosion Testing of Olive Drab Coating Systems	Topcoat Vehicle	Epon 1009: Diethylene Triamine (DET) Epon 1009: Diethylene Triamine (DET) Epon 1009: Diethylene Triamine (DET)	Midland X-4209: Versamid 115 Midland X-4209: Versamid 115 Midland X-4209: Versamid 115	Midland X-4209: Dow Corning 2-6020 Midland X-4209: Dow Corning 2-6020 Midland X-4209: Dow Corning 2-6020	Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115	Dow Corning XR-6-0000: Dow Corning Z-6020 Dow Corning XR-6-0000: Dow Corning Z-6020 Dow Corning XR-6-0000: Dow Corning Z-6020	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75
	Topcoat Code	301-117-F 301-117-F 301-117-F	301-134-A 301-134-A 301-134-A	301-134-B 301-134-B 301-134-B	301-134-C 301-134-C 301-134-C	301-134-D 301-134-D 301-134-D	301-118-F 301-118-F 301-118-F
	Primer Code	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B

Bimetallic Corrosion Rating System

Condition of Panel	Perfect Very few very small blisters or	Slight discoloration. Many small and few medium blisters.	Many small and medium blisters. Few	Large blisters and slight corrosion. Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	500	200	200	Less than 500	Less than 500
Rating 0	-	7	ന	4	رم

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 43

	Hours Tested	800	800 1600	- 800 2000	- 800 2000	2000 800 2000	2000	2000	2000	2000
5% Salt Spray Testing of Olive Drab Coating Systems	Results	Not Tested Some small blisters; lifting on scribe Very few small blisters, slight lifting and corrosion	Not Tested Some small and one medium blister, cracking and slight corrosion Very few very small blisters; corrosion and few small blisters on scribe	Not Tested Few small blisters, cracking and discoloration Few small blisters, slight lifting; some corrosion on scribe	Not Tested Some small blisters Slight corrosion and lifting; few small blisters on scribe	Few medium blisters, slight discoloration; corrosion on scribe Many small blisters, slight discoloration Few small blisters and slight corrosion on scribe	Some medium blisters, slight discoloration; slight corrosion	Not lested Slight lifting and corrosion; few small blisters on scribe	Cracking and discoloration; few small blisters and slight corrosion	Many blisters, slight discoloration; slight corrosion on scribe Very few small blisters and slight corrosion on scribe
	Adhesion	- 50	_ 2P 0	- 2P 0	- 2P 4	1P 2 0	1.5	0	0	0 0
	Topcoat Code	301-112-A 301-112-A 301-112-A	301-112-B 301-112-B 301-112-B	301-112-C 301-112-C 301-112-C	301-113-A 301-113-A 301-113-A	301-113-B 301-113-B 301-113-B	301-113-C 301-113-C	301-113-C	301-114-C	301-114-C 301-114-C
	Primer Code	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D	301-131-B	301-103-A	301-101-D 301-131-B

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Table 43 (continued)

5% Salt Spray Testing of Olive Drab Coating Systems

Hours	2000 800 2000	2000 1800 2000	2000 2000 2000	1800 600 2000	600	600	1600 600 2000
Results	Slight corrosion and one medium blister on scribe Many small blisters Very slight lifting along scribe	Very few small blisters, slight lifting and discoloration Many blisters and slight lifting Discoloration, slight corrosion; slight lifting on scribe	Discoloration; few medium blisters and slight corrosion on scribe Discoloration; slight lifting on scribe Slight corrosion; few small blisters and slight lifting on scribe	Discoloration, many small blisters, lifting, corrosion Many small blisters Slight corrosion; few small blisters and slight lifting on scribe	Many small blisters Cracking, slight discoloration Slight corrosion and discoloration; many very small blisters on scribe	Many small blisters Many small blisters Few small blisters and slight corrosion; very slight lifting and discoloration on scribe	Many very small blisters, cracking, discoloration Many small blisters Slight lifting, discoloration, and corrosion; few small blisters on scribe
Adhesion	255	2P 4 1	2P 5 0	1P 1P 0	5 4P 0	4P 1	4 P 0
Topcoat Code	301-115-A 301-115-A 301-115-A	301-117-A 301-117-A 301-117-A	301-117-B 301-117-B 301-117-B	301-117-C 301-117-C 301-117-C	301-117-D 301-117-D 301-117-D	301-117-E 301-117-E 301-117-E	301-117-F 301-117-F 301-117-F
Primer Code	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B	301-103-A 301-101-D 301-131-B

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Table 43 (continued)

		31	5% Salt Spray Testing of Olive Drab Coating Systems	;
Primer Code	Topcoat Code	Adhesion	Results	Hours
301-103-A	301-134-A	0	Few small blisters and slight lifting on scribe	2000
301-101-D	301-134-A	2	Few small blisters, slight discoloration	2000
301-131-B	301-134-A	0	Very slight lifting and few very small blisters on scribe	2000
301-103-A	301-134-B	1	Not Tested	•
301-101-D	301-134-B	9	Discoloration, few small blisters: slight corrosion on scribe	1800
301-131-B	301-134-B	0	Very slight corrosion and slight lifting; discoloration and very few very small blisters on scribe	2000
301-103-A	301-134-C	1.P	Lifting, slight discoloration, many very small and two small blisters: few small blisters on scribe	2000
301-101-D	301-134-C	7	Three medium blisters, slight lifting	1200
301-131-B	301-134-C	0	Very slight lifting; very few very small blisters and slight corrosion on scribe	2000
301-103-A	301-134-D	2P	Cracking, slight discoloration, and lifting; slight corrosion on scribe	1200
301-101-D	301-134-D	5	Very few small blisters, cracking, slight lifting and discoloration	1600
301-131-B	301-134-D	0	Discoloration; slight lifting and corrosion on scribe	2000
301-103-A	301-118-F	7	Many very small blisters and slight lifting	2000
301-101-D	301-118-F	ı	Not Tested	•
301-131-B	301-118-F	0	Very few blisters, very slight lifting and corrosion, all on scribe	2000

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Adhesion Rating System

Rating 0	Description Excellent Adhesion Less than 10% failure, topcoat from	Rating 0	Description Excellent Adhesion Less than 10% failure, primer from
	primer 10-25% failure, topcoat from primer	2P	substrate 10-25% failure, primer from substrate
	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
	50-75% failure, topcoat from primer	4Þ	50-75% failure, primer from substrate
	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

Section VI

Development of White Topcoat

A. Initial Vehicles Used

The vehicles found in Part A of the primer section were used to prepare white topcoats. One resin system, the combination of Dow Corning R-6-0031 and Bakelite BRS-2600, was not used because of its dark color.

B. Pigmentation

The pigment chosen for the white topcoats was sulfateprocess rutile titanium dioxide. The coatings were flatted to the approximate gloss required with talc. A 53% pigment content by weight was used.

C. Preparation of Panels

The same procedure used for preparation of olive drab coating systems was followed with the white systems. Only the 301-103-A and 301-131-B primers were used.

D. <u>Bimetallic Corrosion and Salt Spray Testing</u>

Bimetallic corrosion and salt spray tests were conducted in the usual manner.

Although the white coating systems were generally inferior in performance to the olive drab systems, the following were considered to have performed well enough to merit additional testing:

	Primer	Topcoat
1.	301-103-A	301-164-D
2.	301-131-B	301-163-F
3.	301-131-В	301-183-В
4.	301-103-A	301-183-D
5.	301-103-A	301-210-4

For results of salt spray and bimetallic corrosion testing of white coating systems, see Tables 44 and 45.

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Table 44

Bimetallic Corrosion Testing of White Coating Systems

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-163-A	Midland R-62: 놯" RS Nitrocellulose	3.6
301-131-B	301-163-A	Midland R-62: 놯" RS Nitrocellulose	
301-103-A	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	ოო
301-131-B	301-163-B	Dow Corning R-6-0031: ½" RS Nitrocellulose	
301-103-A	301-163-C	Plaskon ST-856: ½" RS Nitrocellulose	es vo
301-131-B	301-163-C	Plaskon ST-856: ½" RS Nitrocellulose	
301-103-A 301-131-B	301-163-D 301-163-D	Dow Corning DC-803: ½" CAB Dow Corning DC-803: ½" CAB	ოო
301-103-A 301-131-B	301-163-F 301-163-F	Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB	53
301-103-A	301-163-E	General Electric SR-82: Formvar 7/70	7 7
301-131-B	301-163-E	General Electric SR-82: Formvar 7/70	
301-103-A	301-164-A	Kel-F 800: Acryloid A-101	N. H.
301-131-B	301-164-A	Kel-F 800: Acryloid A-101	
:	301-164-B	Kel-F Fluorel: Acryloid A-101	ပ
301-103-A	301-164-D	Midland R-55: Plaskon ST-847	5 0
301-131-B	301-164-D	Midland R-55: Plaskon ST-847	
;	301-164-E	Roskydol 500	ၓ
301-103-A	301-183-A	Epon 1001: Versamid 115	7 7
301-131-B	301-183-A	Epon 1001: Versamid 115	

Table 44 (continued)

Bimetallic Corrosion Testing of White Coating Systems

		DIMECALLIC COLLOSION TESTLING OF WILLIE COSTLING SYSTEMS	
Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-183-B	Epon 1001: Dow Corning 2-6020	13
301-131-B	301-183-B	Epon 1001: Dow Corning 2-6020	
301-103-A	301-183-C	Epon 1001: Diethylene Triamine (DET)	44
301-131-B	301-183-C	Epon 1001: Diethylene Triamine (DET)	
301-103-A	301-183-F	Epon 1009: Versamid 115	44
301-131-B	301-183-F	Epon 1009: Versamid 115	
301-103-A	301-183-G	Epon 1009: Dow Corning 2-6020	ν ν
301-131-B	301-183-G	Epon 1009: Dow Corning 2-6020	
301-103-A	301-183-H	Epon 1009: Diethylene Triamine (DET)	νv
301-131-B	301-183-H	Epon 1009: Diethylene Triamine (DET)	
301-103-A	301-183-D	Midland X-4209: Versamid 115	7 7
301-131-B	301-183-D	Midland X-4209: Versamid 115	
301-103-A	301-183-E	Midland X-4209: Dow Corning Z-6020	3.2
301-131-B	301-183-E	Midland X-4209: Dow Corning Z-6020	
301-103-A	301-210-A	Dow Corning XR-6-0000: Versamid 115	7 7
301-131-B	301-210-A	Dow Corning XR-6-0000: Versamid 115	
301-103-A	301-210-B	Dow Corning XR-6-0000: Dow Corning Z-6020	7 7
301-131-B	301-210-B	Dow Corning XR-6-0000: Dow Corning Z-6020	
301-103-A	301-182-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	ოო
301-131-B	301-182-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	500	500	500	500	Less than 500	Less than 500
Rating	0	~	7	n	4	'n

N. T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 45

	Hours	2000	200	2000	2000	2000	2000	2000	2000	2000	200
Salt Spray Testing of White Coating Systems	Results	Completely unaffected Many very small blisters and very slight corrosion on scribe	Severe cracking Completely unaffected	Not Tested Very slight corrosion on scribe	Very few very small blisters and very slight corrosion on scribe Few very small blisters and very slight corrosion on scribe	Very slight corrosion and lifting on scribe Many very small blisters	Many small blisters and slight corrosion on scribe Very slight corrosion on scribe	Yellowing; one small blister and very slight corrosion on scribe Yellowing; few very small blisters and slight corrosion on scribe	Few small blisters; very slight corrosion on scribe Many very small blisters; very slight corrosion and lifting on scribe	Completely unaffected Very slight corrosion on scribe	Many small blisters Many very small blisters and slight corrosion on scribe
5% Sa	Adhesion	s 0	«О	10	00		3	ى دى د	00	0	00
	Topcoat Code	301-163-A 301-163-A	301-163-B 301-163-B	301-163-C 301-163-C	301-163-D 301-163-D	301-163-F 301-163-F	301-163-E 301-163-E	301-164-D 301-164-D	301-183-A 301-183-A	301-183-B 301-183-B	301-183-C 301-183-C
	Primer Code	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B	301-103-A 301-131-B

Table 45 (continued)

Systems
Coating
f White
Testing o
Spray
Salt
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	Tested	2000	200	200	2000	1600	2000	2000	7007	2000	2000	2000	2000	2000	2000	2000	2000
5% Salt Spray Testing of White Coating Systems	Results	Many very small blisters; few small blisters and very slight corrosion	on scribe Many small blisters	Severely cracked	Few small blisters; very slight corrosion and slight lifting on scribe	Many very small blisters and slight cracking; slight lifting and corrosion on scribe	Slight corrosion on scribe	Few small blisters, very slight corrosion and slight lifting, all on scribe Few very small blisters and slight corrosion on scribe	to the second control of the control of sections	Few very small blisters and moderate corrosion on scribe	Few small blisters; slight corrosion on scribe	Many very small blisters; very slight corrosion on scribe	Many very small blisters and very slight corrosion on scribe	Yellowed, few very small blisters; few small blisters and slight corrosion	Yellowed; very slight corrosion on scribe	Many very small blisters; few small blisters, slight corrosion and slight	Few very small blisters and slight corrosion on scribe
22	Adhesion	2	0	e	S	0	0	00	•	0	0	2	0	2	0	\$	0
	Topcoat Code	301-183-F	301-183-F	301-183-6	301-183-6	301-183-н	301-183-н	301-183-D 301-183-D		301-183-E	301-183-E	301-210-A	301-210-A	301-210-B	301-210-B	301-182-в	301-182-B
	Primer Code	301-103-A	301-131-B	301-103-A	301-131-B	301-103-A	301-131-B	301-103-A 301-131-B		301-103-A	301-131-B	301-103-A	301-131-B	301-103-A	301-131-B	301-103-A	301-131-B

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Adhesion Rating System

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Section VII

Epoxy Ester and Silicone Epoxy Ester Coatings

A. 301-103-A Primer

This primer, containing a blend of Midland R-55 epoxy ester and Plaskon ST-847 silicone-epoxy ester copolymer was one of the two best primers for inhibiting galvanic corrosion. However, it did not provide good adhesion for most topcoats. The following were tried in an attempt to improve this property:

- 1. The drier content was increased and decreased.
- The time between applying the primer and applying the topcoat was varied.
- 3. The topcoats were reduced with methyl isobutyl ketone to try to soften the primer just enough to provide better adhesion.
- The pigment volume concentration of the topcoats was increased and decreased.

None of the above was successful with the exception of topcoating within 24 hours after applying the primer.

This was believed to be too impractical to merit further consideration.

B. Preparation and Testing of New Vehicles

Since primer 301-103-A was a blend of an epoxy ester and a silicone-epoxy ester copolymer, it was thought that a silicone-epoxy ester copolymer approximately equal to the blend in composition might have some properties superior to the blend. For this reason, the following resins were prepared:

Code	Epoxy	Fatty Acid	<u>Silicone</u>
X-4235	40% Epon 1001	30% Linseed	30% Dow Corning 8-6018
X-4237	49% Epon 1001	36% Tall	15% Dow Corning 2-6018
X-4238	49% Epon 1001	36% Linseed	15% Dow Corning 8-6018
X-4240	49% Epon 1001	36% DCO	15% Dow Corning E-6018
X-4241	51% Epon 1001	39% Linseed	10% Dow Corning E-6018
X-4243	51% Epon 1001	39% Tall	10% Dow Corning 2-6018
X-4245	51% Epon 1001	39% DCO	10% Dow Corning E-6018
X-4253	49% Epon 1001	36% DCO	15% Dow Corning Sylkyd 50
x-4255	51% Epon 1001	39% DCO	10% Dow Corning Sylkyd 50
X-4257	49% Epon 1001	36% DCO	15% Dow Corning X2-6088
X-4263	49% Epon 1001	36% Safflower	15% Dow Corning E-6018
X-4266	51% Epon 1001	39% Safflower	10% Dow Corning E-6018
X-4271	49% D.E.R. 661	36% Safflower	15% Dow Corning 2-6018
X-4278	49% Epon 1001	36% Soya	15% Dow Corning E-6018
X-4282	49% D.E.R. 661	36% DCO	15% Dow Corning E-6018
X-4283	49% Araldite 6071	36% DCO	15% DowCorning 2-6018
X-4295	49% Epon 1001	36% DCO	15% Dow Corning E-6018
X-4296	49% Epon 1007	36% DCC	15% Dow Corning B-6018
x-4300	49% Epon 1001	36% DCO	15% Union Carbide XR-820

The silicone-epoxy ester copolymers were prepared in the following manner:

- 1. The fatty acid was heated to approximately the melting point of the epoxy resin. For epoxy resins with epoxide equivalent weights of 500, the temperature was 210-250°F. For epoxies with epoxide equivalent weights of 900-1,000 and 2,000-2,500, the temperatures to which the fatty acids were heated were 300 F and 350 F, respectively. In some cases, a catalytic quantity of triphenyl phosphite was added after the fatty acids reached the desired temperature. A blow of inert gas was used throughout the cook.
- 2. The epoxy resin was added and the mixture was blown at 520°F for 1 hour. The acid number would be in the range of 1-5 after this time.
- 3. The temperature was lowered to 400°F and the silicone intermediate and a portion of the solvent was added. Some octoic acid was added as a catalyst when Dow Corning Sylkyd 50 and Union Carbide XR-620 were used. The material was refluxed about 10 hours or until viscous. The remainder of the solvent was added.

In addition some counterparts of Midland R-55 were prepared to determine the effect of different oils on the performance of this resin. Midland X-3540, X-3548, and X-4334 contained linseed, DCO, and soya fatty acids, respectively. The following commercial epoxy esters were also evaluated:

- 1. Reichhold Epotuf 6401
- 2. Jones-Dabney Epitex 120
- 3. Jones-Dabney Epitex 1241
- 4. Jones-Dabney Epitex 1486
- 5. Midland R-2

C. Screening of Clear Resins

The epoxy esters and the silicone-epoxy ester copolymers mentioned above were screened in clear coatings by themselves and, when indicated, in combination with each other. The results of this testing can be found in Table 46. All coatings made from the same resin differ only in drier content. The following ratio of driers (based on metal content by weight) was used throughout.

- 3 parts cobalt
- 4 parts calcium
- 2 parts rare earth

D. Epoxy Ester Primers

Since the pigment level chosen for evaluation of the primers was set at 35% by weight only on the basis of previous work in this field, a study of the effect of pigment concentration on corrosion resistance was undertaken. The Midland R-55: Plaskon ST-847 vehicle was chosen for this work and the pigment content was varied from 0 to 65% by weight. It was found that the 35% pigment level was as good a choice as could be made. For bimetallic corrosion and salt spray testing of these coatings, see Tables 47 and 48. (See fig. 8)

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Table 46

Screening Epoxy Ester Resins

Coatings Made from Same Resin Combination Differ Only in Drier Content.

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Table 46 (continued)

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Resins
Ester
Epoxy
Screening
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Code	Resin	<u>Drier Content</u>	Air D	Air Dried Film Dry Adhesion	30 min. @500F Adh. Film Integri	. @500F. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lub 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-155-E	R-55	%060° 0	0	2	-	0.K.	-	0.K.	Q	•	ם	•
301-155-F	R-55	0.060%	0	7		0.K.	~ 4	О.К.	S	YES	ב	
301-155-G	R-55	0.030%	0	2	-	0.K.	7	0.K.	S	YES	ם	•
301-165-A	X-4255	%060-0	-	ო		0.K.	0	0.K.	S	YES	D	
301-165-B	X-4255	0.060%	_	٣	,I	0.K.	0	0.K	S	YES	· =	
301-165-C	X-4255	0.030%	-	٣	-	0.K.	0	0.K.	ß	YES	n	•
301-165-D	X-4253	%060°C	2	ო	-	0.K.	0	0.K	တ	YES	b	•
301-165-E	X-4253	%090°n	7	٣	7	0.K.	0	0.K	တ	YES	ם כ	•
301-165-F	X-4253	0.030%	7	ო	,	0.K.	0	0.K.	S	YES	D	ı
301-165-G	X-4257	0.080%	ч	2	1	0.K.	0	О.К.	Q	ı	D	•
301-165-н	X-4257	0.055%	-	2	7	0.K.	0	0.K	Q	•	s	<u>Q</u>
301-165-K	X-4257	0.025%	7	2		O.K.	0	0.K.	Q	1	S	ON
301-161-A	X-4263	%060° 0	0	2	-	0.K.	-	0.K.	S	YES	n	
301-161-B	X-4263	0.060%	0	2	1	0.K.	-	0.K	S	YES	n	•
301-161-C	X-4263	0.030%	0	2	-	0.K.	1	0.K.	တ	YES	Ω	•
301-161-D	X- 4266	%060°0	0	2	7	0.K.	-	О.К.	Ω	•	S	ON.
301-161-E	X-4266	0.060%	0	2	-1	0.K.	-	0.K.	Ω	•	D	•
301-161-F	X- 4266	0.030%	0	2	~	0.K.	1	0.K.	Q	ı	S	NO
301-161-G	X-4271	%060. 0	0	3	2	0.K.	2	0.K.	S	YES	n	
301-161-1	X-4271	0.060%	0	m	2	О.К.	7	0.K.	S	YES	ລ	1
301-161-K	x- 4271	0.030%	0	ო	ന	0.K.	7	0.K.	Ω	•	n	•

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Table 46 (continued)

Resins	
Ester	
Epoxy	
Screening	

Lubricant 4 hr. 24 hr. Immers. Recovery	S NO O	 n n	 n n	S NO S DO D	n n		 n
	YES	YES YES YES	YES YES YES				YES YES
MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	S Q Q	s s s	8 8 8	000	999	111	s s
@500F. Film Integrity	0 0 °.K.	0.8 0.8 0.8	0.K. 0.K.	0.K. 0.K.	0.K.	1 1 1	0.K. 0.K.
2 hr. @500F Adh. Film Integr	5 2 1	533	888	777		1 1 1	
30 min. @500F. Adh. Film Integrity	0.K.	0.0 0.K.	0.K. 0.K.	0.°. 0.°.	0.K. 0.K.		0.K. 0.K.
30 min	000	5 5 3	5 2 3	ოოო		t / †	7 7
Air Dried Film Dry Adhesion	0 -	66 8	926	തനന	000	សសស	ოო
Air		ннн	- 7 T		000	000	
Drier Content	0.090% 0.060% 0.030%	0.090% 0.060% 0.030%	0.090% 0.060% 0.030%	0.090% 0.060% 0.030%	0.090% 0.060% 0.030%	0.090% 0.060% 0.030%	%090°0
Resin	X-4278 X-4278 X-4278	X-4282 X-4282 X-4282	x-4283 x-4283 x-4283	x-4278 x-4278 x-4278	X-4295 X-4295 X-4295	X-4296 X-4296 X-4296	x-4300 x-4300
Code	301-161-L 301-161-M 301-161-N	301-189-A 301-189-B 301-189-C	301-189-D 301-189-E 301-189-F	301-189-G 301-189-H 301-189-K	301-189-L 301-189-M 301-189-N	301-206-A 301-206-B 301-206-C	301-206-D 301-206-E

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Table 46 (continued)

	Lubricant 4 hr. 24 hr. Inmers. Recovery	n n	ה ה ה	S NO N	 D.D		י י ח ח	י י ח	 n	n n	 n
	136 Fluid 24 hr. Recovery	YES	YES	YES	YES	1 1	YES	YES YES	YES	YES YES	YES
	MIL-S-3 4 hr. Inmers.	ωω	တ တ	လ လ	S) S)	1 1	တလ	တတ	တ တ	တလ	တ လ
	2 hr. @500F. Adh. Film Integrity	0.K.	0.K.	0.K.	0.K.		0.K.	0.K.	0.K.	0.K.	0.K.
ins	2 hr Adh.					i I				1 0	00
y Ester Res	30 min. @500F. Adn. Film Integrity	0.K.	0.K.	0.K.	0.K.		0.K.	0.K.	0.K.	0.K.	0.K.
Screening Epoxy Ester Resins	30 mi				- -		2		,I ,I		00
	Air Dried Film Dry Adhesion	ෆා ෆ	ო ო	ო ო	നന	νv	ოო	5 3	en en	m m	ო ო
	Air	00	00	00	00	88	1 5				1
	Content	0.060% 0.090%	%060°0	%060°0	%060°0	0.060% 0.090%	%060°0	%060°0	%060°0	%060°0	%060°0
			25% ST-847 25% ST-847	50% ST-847 50% ST-847	7 5% ST-847 75% ST-847		25% R-55 25% R-55	50% R-55 50% R-55	25% R-55 25% R-55	50% R-55 50% R-55	25% R-55 25% R-55
	Resin	X-4334 x-4334	75% X-4334: 75% X-4334:	50% X-4334: 50% X-4334:	25% X-4334: 25% X-4334:	X-3540 X-3540	75% X-4240: 75% X-4240:	50% X-4240: 50% R-55 50% X-4240: 50% R-55	75% X-4263: 75% X-4263:	50% X-4263: 50% X-4263:	75% X-4283: 75% X-4283:
	Code	301-240-A 301-240-B	301-240-C 301-240-D	301-240-E 301-240-F	301-240-G 301-240-H	301-242-F 301-242-G	301-243-A 301-243-B	301-243-C 301-243-D	301-243-E 301-243-F	301-243-G 301-243-H	301-244-A 301-244-B

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Table 46 (continued)

				Scre	ening Ep	Screening Epoxy Ester Resins	Resins					
Code	Resin	Drier	Air D	Air Dried Film Dry Adnesion	30 min. Adh.	30 min. @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adn. Film Integrity	MIL-S-3 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	Lubi 4 hr. Immers.	Lubricant 24 hr.
301-244-C 301-244-D	50% X-4283: 50% R-55 50% X-4283: 50% R-55	0.060% 0.090%		1 5	00	0.K. 0.K.	00	0.K.	လ လ	YES	ממ	1 1
301-244-E	75% X-3540: 25% ST-847 0.060%	7090.07	-	2	-	0.K.	1	0.K.	S	YES	Ð	•
301-244-F 301-244-G 301-245-D	X-3548 X-3548 X-3548	0.060% 0.090% 0.030%	1 5 5	222	ннн	0.K. 0.K. 0.K.		0.K.	Q Q S	- YES	מממ	
301-244-H 301-245-E	75% X-3548: 25% ST-847 0.060% 75% X-3548: 25% ST-847 0.030%	7 0.060% 7 0.030%		7 7		0.K. 0.K.	႕႕	0.K.	ΩS	- YES	n	t i
301-335-A 301-335-B	EPOTUF 6401 EPOTUF 6401	0.060%	2 2	00	1 2	0.K. 0.K.		0.K. 0.K.	လ လ	YES	ממ	
301-335-C 301-335-D	EPITEX 120 EPITEX 120	0.060%	2 2	00		0.K. 0.K.	00	0.K. 0.K.	လ လ	YES	n	
301-335-E 301-335-F	EPITEX 1341 EPITEX 1341	0.060% 0.120%	3 5	0	0	0.K. 0.K.	0	0.K.	လ လ	YES	လ လ	ON ON
301-335-G 301-335-H	EPITEX 1486 EPITEX 1486	0.060%	7 7	00	0	0.K. 0.K.	00	0.K. 0.K.	လ လ	NO NO	လ လ	NO ON
301-335-J 301-335-K	Midland R-2 Midland R-2	0.060%	7 7	00	00	0.K	00	0.K. N.G.	QQ		တ တ	ON ON

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Table 46 (continued)

Resins
Ester
Ероху
Screening

				;	91171177	לעטלו	MCSTIIS					
Code	Resin	Drier	Air D Dry	Air Dried Film Dry Adhesion	30 min. Adh.	@500F. Film	2 hr. Adh.	G500F. Film	MIL-S-3	MIL-S-3136 Fluid 4 hr. 24 hr.	Lub)	Lubricant 24 hr.
					뒤	Integrity		Integrity	Immers.	Recovery	Lumers.	Recovery
301-336-A	50% EPOTUF 6401:50% ST-847	×090°0	-	0	0	0.K.	0	0.K.	S	YES	S	QV.
301-336-B	50% EPOTUF 6401:50% ST-847	0.120%	-	0	0	0.K.	0	O.K.	S	YES	S	NO.
301-336-C	75% EPOTUF 6401:25% ST-847 0.060%	%090*0		0	1	0.K.	1	0.K.	S	YES	b	•
301-336-D	75% EPOTUF 6401:25% ST-847	0.120%		0	-	0.K.	н	0.K.	S	YES	n	
301-336-E	EPITEX 120:	%090°0	0	0	0	0.K.	0	О.К.	S	YES	v	ON.
301-336-F	50% EPITEX 120: 50% ST-847	0.120%	_	0	0	0.K.	0	O.K.	S	YES	S	ON ON
301-336-C	EPITEX 120: 25%		0	0	0	0.K.	0	О.К.	S	YES	Þ	
301-336-Н	75% EPITEX 120: 25% ST-847	0.120%	٦,	0	0	0.K.	0	0.K.	S	YES	Þ	
301-336-J	50% EFITEX 1341:50% ST-847	0.060%	1	0	0	0.K.	0	0.K.	S	YES	W	ON
301-337-A	50% EPITEX 1341:50% ST-847	0.120%	7	0	7	О.К.	0	0.K.	S	YES	S	ON
301-337-B	/5% EPITEX 1341:25% ST-847 0.060%	0.060%	٣	0	1	0.K.	Н	0.K.	S	YES	S	ON
301-337-C	75% EPITEX 1341:25% ST-84/	0.120%	2	0	1	O.K.	-	О.К.	s	YES	S	NO.
301-337-D	50% EFITEX 1486:50% ST-847	%090°0	, -4	0	0	0.K.	0	0.K.	S	YES	v	ON
301-337-E	50% EPITEX 1486:50% ST-847	0.120%	_	0	0	0.K.	0	0.K.	s	YES	တ	ON
301-337-F		%090°0	2	0	1	0.K.	-	0.16.	v	YES	v	C
301-337-G	75% EPITEY 1486:25% ST-84,	0.120%	7	0	1	0.K.	-	o.K.	S	YES	လ	S S
301-337-н	50% Midland R-2:50% ST-84/ 0.060%	0.060%	-	0	0	0.K.	0	О.К.	Ω	0.1	W	0.
301-337-J	50% Midland R-2:50% ST-847	0.120%	_	0	0	0.K.	0	0.K.	S	YES	S	ON
301-338-A	/5% Midland R-2:25% ST-847		7	0	0	0.K.	0	О.К.	Q	ı	S	Q
301-338-B	75% Midland R-2:25% ST-847	0.120%	7	0	0	0.K.	0	0.K.	Q	•	S	NO.

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Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	-	2	e	4	5

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

Yes - Recovered original properties No - Did not recover original properties

Table 47

Effect of Pigment Content in Midland R-55: Plaskon ST-847 Primer on

Bimetallic Corrosion Resistance

Primer Code	Primer Vehicle	Pigment Content	Digmont	
301-134-E	75% Midland R-55: 25% Plaskon ST-847	65%	Zine Chromote	Karıng
301-135-A	75% Midland R-55: 25% Plaskon ST-847	255	Zino Changle	n (
301-135-B	75% Midland R-55: 25% Plaskon et-867	? 8	TING CHICOMBIE	^
301-103-4	TO TO TOTAL STATE OF THE STATE	754	Zinc Chromate	m
(301-135-C)	/3% Midland R-55: 25% Plaskon ST-847	35%	Zinc Chromate	2
301-135-D	75% Midland R-55: 25% Pleskon ST-847	25%	Zinc Chromate	c
301-135-E	75% Midland R-55: 25% Plaskon ST-847	15%	Zinc Chromate	n n
301-90-F	75% Midland R-55: 25% Plaskon ST-847	20		n 2

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	500	Less than 500	Less than 500
Rating	0	1	2	e	7	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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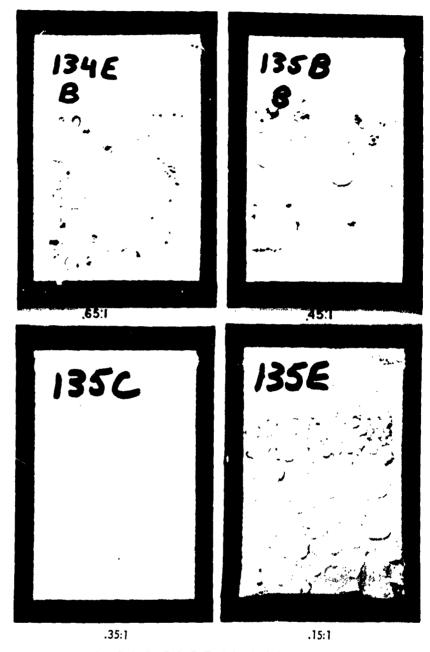
Table 48

Effect of Pigment Content in Midland R-55: Plaskon ST-847 Primer

on 5% Salt Spray Performance

	on 26 Sail Spiay remounance	
Primer Code	Results	Hours Tested
301-134-E	Many very small blisters; slight corrosion and lifting on scribe.	1800
301-135-A	Very few very small blisters.	2000
301-135-B	Completely unaffected.	2000
301-103-A (301-135-C)	Completely unaffected.	2000
301-135-D	Few very small blisters on scribe.	2000
301-185-E	Completely unaffected.	2000
301-90-F	Severely blistered.	007

FIG. 8



EFFECT OF PIGMENT - TOTAL SOLIDS RATIO

Fig. 8

EFFECT OF PIGMENT CONTENT ON GALVANIC CORROSION

RESISTANCE OF A SILICONE-EPOXY: POLYAMIDE PRIMER

The following resin systems were believed worthy of testing based on results of screening tests on the clear resins:

- 1. Midland X-4240
- 2. 75% Midland R-55 25% Midland X-4235
- 3. Midland R-55
- 4. Midland X-4245
- 5. Midland X-4263
- 6. Midland X-4271
- 7. Midland X-4282
- 8. Midland X-4283
- 9. Midland X-4300
- 10. 50% Midland X-4283 50% Midland R-55
- 11. 50% Midland X-4240 50% Midland R-55
- 12. 50% Midland X-4263 50% Midland R-55
- 13. Midland X-3548
- 14. 75% Midland X-3548 25% Plaskon ST-856
- 15. Midland X-4334
- 16. Midland X-3540
- 17. 75% Midland X-3540 25% Plaskon ST-847
- 18. Reichhold Epotuf 6401
- 19. 75% Reichhold Epotuf 6401 25% Plaskon ST-847
- 20. Jones-Dabney Epitex 120

- 21. 75% Jones-Dabney Epitex 120 25% Plaskon ST-847
- 22. Jones-Dabney Epitex 1341
- 23. 50% Jones-Dabney Epitex 1341 50% Plaskon ST-847
- 24. 75% Jones-Dabney Epitex 1486 25% Plaskon ST-847
- 25. 50% Jones-Dabney Epitex 1486 50% Plaskon ST-847

To expedite testing of these vehicles in primers, many of the primers were made using only zinc or calcium chromate as pigment. Earlier testing of primers had shown the strontium chromate to be an ineffective corrosion inhibitor. In some of the primers the calcium chromate also was not used since the zinc chromate appeared to be the best pigment in epoxy ester coatings.

As a result of the bimetallic corrosion and salt spray testing, the following primers were included in future testing:

- 1. 301-158-C
- 2. 301-158-L
- 3. 301-159-D
- 4. 301-159-G
- 5. 301-202-A

For results of galvanic corrosion and salt spray testing of epoxy ester primers, see Tables 49 and 50.

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Table 49

Bimetallic Corrosion Testing of Epoxy Ester Primers

Primer Code	K	Primer Vehicle	Pigment	Rating
301-158-A 301-158-B 301-158-C	Midland X-4240 Midland X-4240 Midland X-4240		Zinc Chromate Strontium Chromate Calcium Chromate	787
301-158-D 301-158-E 301-158-F	75% Midland R-55: 29 75% Midland R-55: 29 75% Midland R-55: 29	25% Midland X-4235 25% Midland X-4235 25% Midland X-4235	Zinc Chromate Strontium Chromate Calcium Chromate	4 ለ ለ
301-158-G 301-158-H 301-158-K	Midland R-55 Midland R-55 Midland R-55		Zinc Chromate Strontium Chromate Calcium Chromate	444
301-158-L 301-158-M 301-158-N	Midland X-4245 Midland X-4245 Midland X-4245		Zinc Chromate Strontium Chromate Calcium Chromate	744
301-159-A 301-159-B 301-159-C	Midland X-4263 Midland X-4263 Midland X-4263		Zinc Chromate Strontium Chromate Calcium Chromate	พพพ
301-159-D	Midland X-4271		Zinc Chromate	2
301-159-G	Midland X-4282		Zinc Chromate	2
301-202-A	Midland X-4283		Zinc Chromate	2
301-202-E	Midland X-4300		Zinc Chromate	e
301-233-C 301-233-D 301-233-E	50% Midland X-4283: 50% Midland X-4240: 50% Midland X-4263:	50% Midland R-55 50% Midland R-55 50% Midland R-55	Zinc Chromate Zinc Chromate Zinc Chromate	пп м

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Table 49 (continued)

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		Rating	ĸ	က	m	m	m .	າ ຕ ເ	ım (ግ	റന ദ	nm (ൗന നംസ	m m
of Epoxy Ester Primers	76	Juankty	Zinc Chromate	Zinc Chromate	Zinc Chromate	Zinc Chromate	Zinc Chromate Zinc Chromate	Calcium Chromate Zinc Chromate	Calcium Chromate Zinc Chromate	Calcium Chromate Zinc Chromate	Calcium Chromate Zinc Chromate	Calcium Chromate Zinc Chromate	Calcium Chromate Zinc Chromate Calcium Chromate	zinc Chromate Calcium Chromate
Bimetallic Corrosion Testing of Epoxy Ester Primers	Primer Vehicle		48: 25% Plaskon ST-847			0: 25% Plaskon ST-847		25% Plaskon ST-847 25% Plaskon ST-847		25% Plaskon ST-847 25% Plaskon ST-847		50% Plaskon ST-847 50% Plaskon ST-847	25% Plaskon ST-847 25% Plaskon ST-847 50% Plaskon ST-847	30% Plaskon ST-847
		Midland X-3548	75% Midland X-3548:	Midland X-4334	Midland X-3540	75% Midland X-3540:	Epotuf 6401 Epotuf 6401	75% Epotuf 6401: 75% Epotuf 6401:	Epitex 120 Epitex 120	75% Epitex 120: 75% Epitex 120:	Epitex 1341 Epitex 1341	50% Epitex 1341: 50% Epitex 1341:	75% Epitex 1486: 75% Epitex 1486: 50% Epitex 1486: 50% Fritex 1486:	con three 1400:
Prince Code		301-266-F	301-266-G	301-274-A	301-274-B	301-274-C	301-340-B 301-340-E	301-340-C 301-340-F	301-340-H 301-341-B	301-340-J 301-341-C	301-341-E 301-341-H	301-341-F 301-341-J	301-342-B 301-342-E 301-342-C 301-342-F	

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion,	Many blisters and severe corrosion.
Hours Exposed	200	200	200	500	Less than 500	Less than 500
Rating	0	-	7	m	4	٠,

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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Table 50

5% Salt Spray Testing of Epoxy Ester Primers

	an party described tractile of they recent titmers	
Primer Code	Results	Hours Tested
301-158-A 301-158-B 301-158-C	Very slight corrosion and slight lifting on scribe. Many very small blisters and some corrosion. Few very small blisters and very slight corrosion on scribe.	2000 1000 2000
301-158-D 301-158-E 301-158-F	Few very small blisters and very slight corrosion on scribe. Many very small blisters and slight corrosion. Very slight corrosion on scribe.	2000 800 2000
301-158-G 301-158-H 301-158-K	Very few very small blisters; very few very small blisters and very slight corrosion on scribe. Many very small blisters. Few very small blisters and slight corrosion.	2000 600 2000
301-158-L 301-158-M 301-158-N	Very slight corrosion and very few small blisters on scribe. Many very small blisters and slight corrosion; slight lifting on scribe. Slight corrosion on scribe.	2000 1200 2000
301-159-A 301-159-B 301-159-C	Very slight corrosion on scribe. Slight corrosion. Slight corrosion on scribe.	2000 2000
301-159-D	Few small blisters and very slight corrosion on scribe.	2000
301-159-G	Very few very small blisters and very slight corrosion on scribe.	2000
301-202-A	Few very small blisters and slight corrosion on scribe.	2000
301-202-E	Very slight corrosion and slignt lifting on scribe.	2000
301-233-C	Slight corrosion on scribe.	2000
301-233-D	Very slight corrosion; many small and two medium blisters on scribe.	2000

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Table 50 (continued)

5% Salt Spray Testing of Epoxy Ester Primers

Primer Code	Results	Hours Tested
301-233-E	Very slight corrosion; some small blisters on scribe.	2000
301-266-F	Many small and few medium blisters; slight corrosion and many small blisters on scribe.	800
301-266-G	Many very small and few small blisters, slight corrosion.	2000
301-274-A	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-274-B	One medium blister and slight corrosion; few small blisters on scribe.	1600
301-274-C	Many small blisters and slight corrosion on scribe.	2000
301-340-B 301-340-E	Many very small blisters; few small blisters and slight corrosion on scribe. Many small and very small blisters, slight corrosion.	2000
301-340-C 301-340-F	Many very small blisters; slignt corrosion on scribe. Many very small and few small blisters; slight corrosion on scribe.	2000
301-340-H 301-341-B	Many very small and few small blisters; slight corrosion on scribe. Not Tested.	2000
301-340-J 301-341-C	Many very small blisters; few very small blisters and slight corrosion on scribe. Many very small and few small blisters; slight corrosion on scribe.	2000
301-341-E 301-341-H	Many very small and few small blisters; slight corrosion on scribe. Many very small and few small blisters, slight corrosion.	2000
301-341-F 301-341-J	Many very small blisters; slight corrosion on scribe. Some very small blisters; slight corrosion on scribe.	2000

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Table 50 (continued)

5% Salt Spray Testing of Epoxy Ester Primers

Primer Code	Results	Hours Tested
301-342-B 301-342-E	Many very small and few small blisters, slight corrosion. Many very small blisters; slight corrosion on scribe.	2000
301-342-C 301-342-F	Many very small blisters; slignt corrosion on scribe. Many very small and few small olisters; slight corrosion on scribe.	2000 2103

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E. Epoxy Ester Olive Drab Topcoats

Some of the epoxy ester vehicles which were used in the primers were also used in olive drab topcoats.

Most of these coatings did not perform any better than the original coating systems but the following were selected for further testing:

	Primer	Topcoat
1.	301-103-A	301-174-B
2.	301-131-В	301-174-B
3.	301-131-В	301-174-C
4.	301-103-A	301-175-A
5.	301-103-A	301-175-В
6.	301-131-В	301-175 - B

The results of bimetallic corrosion and salt spray testing of epoxy ester olive drab topcoats can be found in Tables 51 and 52.

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Table 51

Bimetallic Corrosion Testing of Epoxy Ester Olive Drab Topcoats

	חדוום	principality collocated teaching of grown gater office prap topcoates	
Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-174-A	Midland X-4240	3.2
301-131-B	301-174-A	Midland X-4240	
301-103-A	301-174-B	Midland X-4235	1
301-131-B	301-174-B	Midland X-4235	
301-103-A	301-174-C	Midland X-4245	e 4
301-131-B	301-174-C	Midland X-4245	
301-103-A	301-175-A	Midland X-4263	3
301-131-B	301-175-A	Midland X-4263	
301-103-A	301-175-B	Midland R-55	
301-131-B	301-175-B	Midland R-55	
301-103-A	301-175-C	Midland X-4271	7 7
301-131-B	301-175-C	Midland X-4271	
301-103-A	301-204-A	Midland X-4282	3.2
301-131-B	301-204-A	Midland X-4282	
301-103-A	301-204-B	Midland X-4283	1 2
301-131-B	301-204-B	Midland X-4283	
301-103-A	301-222-A	Midland X-4300	22
301-131-B	301-222-A	Midland X-4300	
301-103-A	301-234-E	Midland X-3540	77
301-131-B	301-234-E	Midland X-3540	

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Table 51 (continued)

Bimetallic Corrosion Testing of Epoxy Ester Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-235-B	Midland X-4334	5 2
301-131-B	301-235-B	Midland X-4334	
301-103-A	301-235-C	75% Midland X-4334: 25% Plaskon ST-847	2 2
301-131-B	301-235-C	75% Midland X-4334: 25% Plaskon ST-847	
301-103-A	301-278-A	Midland X-3548	7 7
301-131-B	301-278-A	Midland X-3548	

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	200	Less than 500	Less than 500
Rating	0	1	2	e .	4	'n

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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Table 52

5% Salt Spray Testing of Epoxy Ester Olive Drab Topcoats

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A 301-131-B	301-174-A 301-174-A	٥ و	Slight corrosion on scribe. Many small blisters and very slight corrosion.	2000
301-103-A 301-131-B	301-174-B 301-174-B	2 1	Few medium blisters; slight discoloration, lifting, and corrosion, all on scribe. Few very small blisters, slight lifting, and slight corrosion, all on scribe.	20 00 2000
301-103-A 301-131-B	301-174-C 301-174-C	5 1	Few very small blisters, slight lifting, and slight corrosion, all on scribe. Two small blisters, slight corrosion, and slight lifting, all on scribe.	2000
301-103-A 301-131-B	301-175-A 301-175-A	52	Singnt corrosion on scribe. Few very small blisters and slignt corrosion on scribe.	2000 2000
301-103-A 301-131-B	301-175-B 301-175-B	0 1	Few very small blisters, slight corrosion, and very slight lifting, all on scribe. Few very small blisters; slight corrosion, lifting, and discoloration on scribe.	2000
301-103-A 301-131-B	301-175-C 301-175-C	សស	Slignt lifting and corrosion on scribe. Two small blisters, very slignt lifting, very slignt corrosion, all on scribe.	2000
301-103-A 301-131-B	301-204-A 301-204-A	50	One medium blister, very slight corrosion, and very slight lifting, all on scribe. Very slight corrosion and slight lifting on scribe.	2000
301-103-A 301-131-B	301-204-B 301-204-B	\$ 0	Some very small blisters; very slight lifting and corrosion on scribe. Few very small blisters and very slight corrosion on scribe.	2000
301-103-A 301-131-B	301-222-A 301-222-A	νv	Very few small blisters and slight corrosion on scribe. Few small and one medium blister, slight corrosion, slight lifting, all on scribe.	2000
301-103-A 301-131-B	301-234-E 301-234-E	2 5	Some small blisters, moderate corrosion, slight lifting, all on scribe. Few small blisters and very slight corrosion on scribe.	2000

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Table 52 (continued)

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Ester Olive Drab
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of
pray Testing
Spray
5% Salt Spra
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		Hours Tested	2000 2000		2000	2000	1600	1600
a cart spiny lesting of Epoxy Ester Olive Drab Tongrafe	Results	Some small, two large blisters, slight correction	Some very small blisters; many small and some medium blisters, all on scribe. and slight lifting on scribe.	Some very small blisters: some email and force	and lifting on scribe. Some very small blisters, slight corrosion	Few very small blisters, for the corresponding scribe.	and lifting on scribe. Many very small history.	on scribe.
5	Adhesion	m	5	5	0	2	5	
	Topcoat Code	301-235-B	9-77-100	301-235-C	301-235-C	301-278-A	301-278-A	
	Primer Code	301-103-A 301-131-B		301-103-A	301-131-B	301-103-A	301-131-B	

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
	Less than 10% failure, topcoat from primer	1.P	Less than 10% failure, primer from substrate
2	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
٣	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4 P	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5 P	Complete lifting of primer from substrate

F. Epoxy Ester White Topcoats

The same vehicles used in the olive drab topcoats were used for the white coatings. The original pigmentation was used for these coatings. None of these materials performed well enough to merit future work. Galvanic corrosion and salt spray test results can be found in Tables 53 and 54.

Table 53

301-103-A 301-210-E Midland X-4245 301-131-B 301-210-E Midland X-4245
301-103-A 301-210-F

Bimetallic Corrosion Rating System

Rating

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Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blister Very slight corrosion.
Hours Exposed	900	200	200

medium blisters.

Many small and medium blisters. Few large blisters and slight corrosion. Many blisters and severe corrosion. Many blisters and considerable corrosion. Less than 500 Less than 500

500

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N.T. - Not tested due to cracking or other film failure,

G - Coating gelled during preparation.

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Table 54

		5% Sal	5% Salt Spray Testing of Epoxy Ester White Topcoats	:
Primer Code	Topcoat Code	Adhesion	Results	Hours
301-103-A	301-210-C	5	Many very small blisters; few small blisters, slight lifting and corrosion	2000
301-131-B	301-210-C	4	on scribe. Some very small blisters; slight lifting and very slight corrosion on scribe.	2000
301-103-A	301-210-D	5	Yellowing, many very small blisters; few small blisters and very slight	2000
301-131-B	301-210-D	5	corrosion on scribe. Many very small blisters; slight corrosion on scribe.	400
301-103-A 301-131-B	301-210~E 301-210-E	5 2	Some very small blisters; few small blisters and slight corrosion on scribe. Many very small blisters and very slight corrosion on scribe.	2000 2000
301-103-A 301-131-B	301-210-F 301-210-F	iO O	One small blister and very slight corrosion on scribe. Many very small blisters; very slight corrosion on scribe.	2000 2000
301-103-A 301-131-B	301-210-G 301-210-G	0 5	Many very small blisters; very slight corrosion on scribe. Many very small blisters; very slight corrosion on scribe.	2000
301-103-A 301-131-B	301-210-Н 301-210-Н	00	Many very small blisters; many small blisters and slight corrosion on scribe. Many very small and few small blisters, slight corrosion on scribe.	2000
301-103-A 301-131-B	301-211-E 301-211-E	9	Many very small blisters; some small blisters and very slight corrosion on scribe 2000 Many very small blisters; many small blisters and very slight corrosion on scribe 2000	scribe 2000 scribe 2000
301-103-A 301-131-B	301-211-F 301-211-F	\$ 0	Many very small blisters; some lifting and very slight corrosion on scribe. Many very small blisters; very slight corrosion on scribe.	2000

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Adhesion Rating System

ion		ce, primer from	ner from subs trate	ner from substrate	ner from substrate	Complete lifting of primer from substrate
Description	Excellent Adhesion	Less than 10% failure, primer from substrate	10-25% failure, primer from substrate	25-50% failure, primer from substrate	50-75% failure, primer from substrate	Complete lifting of
Rating	0	11	2P	3P	d 7	5P
Description	Excellent Adhesion	Less than 10% failure, topcoat from primer	10-25% failure, topcoat from primer	25-50% failure, topcoat from primer	50-75% failure, topcoat from primer	Complete lifting of topcoat from primer
Rating	0	ı	2	က	4	5

Section VIII

Epoxy and Silicone-Epoxy Copolymer Coatings

A. Preparation and Testing of New Vehicles

Since epoxies and silicone-epoxy copolymers had performed fairly well in the intial testing, it was decided to prepare some copolymers with different silicone contents for evaluation. The following materials were synthesized:

Code	Silicone	Ероху
X-4311	25% Dow Corning R-861	75% Epon 1001
X-4313	(12.5% Dow Corning Z-6018 (12.5% Dow Corning QZ-8-0031	75% Epon 1001
X-4315	25% Dow Corning Z-6018	75% Epon 1001
X-4316	15% Dow Corning 2-6018	85% Epon 1001
X-4317	35% Dow Corning Z-6018	65% Epon 1001
X-4209	50% Dow Corning Z-6018	50% Epon 1001

B. Screening of Clear Resins

The silicone-epoxy copolymers were screened in the usual manner. Versamid 115, Dow Corning Z-6020, and diethylene triamine were used as catalysts. Almost all of these materials were excellent when tested in the clear film as can be seen from Table 55.

C. Epoxy and Silicone-Epoxy Primers

Primers were prepared from a number of epoxy and siliconeepoxy resins. Only two of them, 301-188-C and 301-232-E, were included in future work. Results of bimetallic corrosion and salt spray testing of the epoxy and siliconeepoxy primers can be found in Tables 56 and 57.

Table 55

	Silicone	Χ̈Ι	Screening	ng Stl	Silicone-Epoxy Copolymer Systems	Copoly	mer Systems	ra l					
Vehicle Code	Epoxy Copolymer	Curing Agent	11	Air Dr Dry	Air Dried Film Dry Adhesion	30 min	30 min. @500F. Adh. Film Integrity	2 hr.	2 hr. @500F. Adh. Film Integrity	MIL-S-3	MIL-S-3136 Fluid 4 hr. 24 hr. Imners, Recovery	Lubr 4 hr. Immers.	Lubricant 24 hr. rs. Recovery
301-228-J 301-228-K 301-228-L	X-4311	Versamid 115	10 25 50	101	0 1 1	001	0.K. 0.K.	001	0.K.	ខេត	YES - YES	555	1 1 1
301-229-A 301-229-B 301-229-C	x -4311	Dow Corning Z-6020	2 5 9	000		000	0.00 .K.	000	0.K.	s s n	YES YES	ממם	
301-229-D 301-229-E	X- 4311	DET	2 5	0	п.	00	0.K. 0.K.	00	0.K. 0.K.	nn		n n	
301-228-A 301-228-B 301-228-C	X- 4313	Versamid 115	10 25 50	110	888	004	0.K. 0.K.	0 0 1	0.K. 0.K.	လ လ လ	NO YES	Spp	N
301-228-D 301-228-E 301-228-F	X-4313	Dow Corning 2-6020	2 5 10	0 0 0	121	000	0.K. 0.K.	000	0.K. 0.K.	SSD	YES YES	s n	N 1 1
301-228-G 301-228-H	X -4313	DET	2 5	7	3	00	N.G.	00	N.G. O.K.	s n	YES	s n	YES
301-229-F 301-229-G 301-229-H	x-4315	Versamid 115	10 25 50	000	101	100	0.K.	ппп	0.K. 0.K.	လလလ	YES YES YES	מממ	

Table 55 (continued)

	Lubricant 24 hr.	ο Ο ι ι	ł i	O	Ö ı ı
	Lubr 4 hr. Immers.	son	ממ	s n n	s n n
	IIL-S-3136 Fluid hr. 24 hr.	YES YES	1 1	YES YES YES	YES YES YES
	MIL-S-31 4 hr. Immers.	s s D	ממ	တ လ လ	s s s
	2 hr. @500F. Adh. Film Integrity	0.0. 0.K.	0.K. 0.K.	0.K. 0.K.	0.K. 0.K.
S	Adh.		11		
ymer System	30 min. @500F. Adh. Film Integrity	0.K. 0.K.	0.K.	0.K. 0.K.	0.K. 0.K.
cy Copol	30 min	0 1 1		110	
Screening Silicone-Epoxy Copolymer Systems	Air Dried Film Dry Adhesion	42 4		0	анн
ning Si	Air D	000		000	000
Scree	2	2 5 10	2 2	10 25 50	10 25 50
	Curing Agent	Dow Corning Z-6020	DET	Versamid 115	Versamid 115
Silicone	Epoxy Copolymer	X- 4315	X-4315	X- 4316	X-4317
	Vehicle Code	301-229-J X-4315	301-229-M X-4315 301-229-N	301-231-A X-4316 301-231-B 301-231-C	301-231-D X-4317 301-231-E 301-231-F

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor	
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky	
Rating	0	-	2	e	7	5	

Film Integrity

- 0.K. No perceptible change except for darkening.
 B Blistered
 N.G. Extensive flaking or other loss of film integrity.

24 Hour Recovery	Yes - Recovered original properties No - Did not recover original properties
Gasoline and Lubricant Resistance	U - Unaffected S - Softened D - Dissolved

Table 56 (continued)

Bimetallic Corrosion Testing of Epoxy and Silicone-Epoxy Primer

	1		מות מדידכתוב חליטי וו דווובו	TT THE T	
Primer Code		Primer Vehicle		Pigment	Rating
301-405-B 301-405-A	Eponol H-55.1 - B40 Eponol H-55.1 - B40	75% Pigment 75% Pigment		Zinc Chromate Calcium Chromate	2 50
301-405-D 301-405-E	Eponol H-55.1 - B40 Eponol H-55.1 - B40	65% Pigment 65% Pigment		Zinc Chromate Calcium Chromate	2 50
301-405-F 301-405-G	Eponol H-55.1 - B40 Eponol H-55.1 - B40	50% Pigment 50% Pigment		Zinc Chromate Calcium Chromate	'n
301-275-A 301-275-B	Eponol H-55.1 - B40 Eponol H-55.1 - B40	35% Pigment 35% Pigment		Zinc Chromate Calcium Chromate	'n'n
301-405-C 301-406-A 301-406-B	Eponol H-55.1 - B40 Eponol H-55.1 - B40 Eponol H-55.1 - B40	75% Pigment 65% Pigment 50% Pigment		Iron Oxide Iron Oxide Iron Oxide	พพ
301-406-C 301-406-E	95% Eponol H-55.1 - B40: 95% Eponol H-55.1 - B40:	B40: 5% Mondur CB-75 B40: 5% Mondur CB-75	75% Pigment 75% Pigment	Zinc Chromate Calcium Chromate	งง
301-406-D 301-406-F	85% Eponol H-55.1 - E 85% Eponol H-55.1 - E	85% Eponol H-55.1 - B40: 15% Mondur CB-75 85% Eponol H-55.1 - B40: 15% Mondur CB-75	75% Pigment 75% Pigment	Zinc Chromate Calcium Chromate	N N

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	200	Less than 500	Less than 500
Rating	0	1	7	m	4	\$

N.T. - Not tested due to cracking or other film failure,

G - Coating gelled during preparation.

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Table 57

	5% Salt Spray Testing of Epoxy and Silicone-Epoxy Primers	Hours
Primer Code	Regults	Tested
301-203-G	Very few small blisters; slight corrosion and many small blisters on scribe.	2000
301-203-F	Few small blisters; slight lifting and many very small blisters on scribe.	2000
301-232-D	Few very small blisters; many very small and one large blister on scribe.	2000
301-232-E	Very few small blisters and slight corrosion; many very small blisters and slight corrosion on scribe.	2000
301-232-F	Many very small and few small blisters; few small and many very small blisters, slight corrosion on scribe.	2000
301-188-A 301-188-B 301-188-C	One large blister and corrosion, severe fading; moderate corrosion and many blisters on scribe. Many small blisters, severe fading Very few small blisters and slight lifting; many small blisters on scribe.	400 200 2000
301-128-D 301-188-E 301-188-F	Some corrosion, severe fading. Some corrosion, flaking, and severe fading. Few small blisters, severe fading.	200 700 700
301-188-G	Some corrosion, severe fading; some corrosion on scribe.	200
301-202-D	Many very small blisters and severe fading; moderate corrosion on scribe.	200
301-267-C 301-267-D	Many small blisters and some corrosion; moderate corrosion and lifting on scribe. Many small blisters, moderate corrosion and fading.	800 200
301-266-C 301-266-D	Many small and medium blisters; slight corrosion and lifting on scribe. Many small blisters; slight corrosion and lifting on scribe.	800 200
301-266-E	Many small and medium blisters; slight corrosion and lifting on scribe.	800

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Fable J/ (continued)

3% Salt spray Testing of Epoxy and Silicone-Epoxy Primers

	J. Sail Spiay lesting of Epoxy and Silicone-Epoxy Primers	
Primer Code	Results	Hours
301-405-B 301-405-A	Hany small and very small blisters, slight corrosion, severe fading.	1000
301-405-D 301-405-E	Some small and very small blisters, severe fading; slignt corrosion on scribe. Few small blisters, severe fading, slignt corrosion.	1000
301-405-F 301-405-G	Few small and very small blisters, severe fading, some corrosion.	2000
301-2/5-A 301-2/5-B	any small and tew medium blisters, slight corrosion.	200
301-406-A 301-406-A 301-400-B	some small and very small blisters, one large blister, severe corrosion. The very small and some small blisters, slight corrosion. The very small and some small blisters; slight corrosion on scribe.	2000 2000 2000
301-406-C	Not tested.	7000
301-406-D 301-406-F	Not tested.	

D. Epoxy and Silicone-Epoxy Olive Drab Topcoats

None of the olive drab topcoats made from the epoxy and silicone-epoxy resins performed as well as expected and all were eliminated from future testing. Bimetallic corrosion and salt spray results can be found in Tables 58 and 59.

E. Epoxy and Silicone-Epoxy White Topcoats

Of the white systems tested, only the following was considered satisfactory:

<u>Primer</u> <u>Topcoat</u> 301-131-B 301-211-C

Results of galvanic corrosion and salt spray testing can be found in Tables 60 and 61.

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Table 58

Bimetallic Corrosion Testing of Epoxy and Silicone-Epoxy Olive Drab Topcoats

Rating	7 7	r 7	5 2	7 7	77	53	e v	7 4	A. E.
Topcoat Vehicle	75% Midland X-4311: 25% Versamid 115	75% Midland X-4313: 25% Versamid 115	75% Midland X-4315: 25% Versamid 115	75% Midland X-4316: 25% Versamid 115	75% Midland X-4317: 25% Versamid 115	90% Epon 1001: 10% Shell H-1	90% Midland X-4209: 10% Shell H-1	90% Dow Corning XR-6-0000: 10% Shell H-1	Shell Eponol H-55.1 - B40
	75% Midland X-4311: 25% Versamid 115	75% Midland X-4313: 25% Versamid 115	75% Midland X-4315: 25% Versamid 115	75% Midland X-4316: 25% Versamid 115	75% Midland X-4317: 25% Versamid 115	90% Epon 1001: 10% Shell H-1	90% Midland X-4209: 10% Shell H-1	90% Dow Corning XR-6-0000: 10% Shell H-1	Shell Eponol H-55.1 - B40
Topcoat Code	301-222-D	301-223-B	301-223-D	301-234-B	301-234-D	301-204-c	301-204-E	301-204-F	301-279-A
	301-222-D	301-223-B	301-223-D	301-234-B	301-234-D	301-204-c	301-204-E	301-204-F	301-279-A
Primer Code	301-103-A	301-103-A	301-103-A	301-103-A	301-103-A	301-103-A	301-103-A	301-103-A	301-103-A
	301-131-B	301-131-B	301-131-B	301-131-B	301-131-B	301-131-B	301-131-B	301-131-B	301-131-B

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	500	200	Less than 500	Less than 500
Rating	0	ન	2	m	4	Ŋ

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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Table 59

Topcoats
Drab
Olive
Silicone-Epoxy
and
f Epoxy
Testing o
Spray
5% Salt
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			STRONG TO THE ST	
Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A 301-131-B	301-222-D 301-222-D	3P 0	Many very small and one large blister, slight corrosion; slight lifting on scribe. Many very small and one large blister; few small blisters, slight corrosion and lifting on scribe.	2000
301-103-A 301-131-B	301-223-B 301-223-B	3.P 0	Many very small blisters; one large blister, slight corrosion and lifting on scribe. 2000 Many very small blisters; one medium blister, slight corrosion and lifting on scribe.	2000
301-103-A	301-223-D	1	Some very small blisters; few medium blisters, moderate corrosion and slight	2000
301-131-B	301-223-D	0	lifting on scribe. Two large and few medium blisters, moderate corrosion, slight lifting and discoloration, all on scribe.	2000
301-103-A	301-234-B	3P	Very few small blisters; two large and some medium blisters. moderate corrosion	2000
301-131-B	301-234-B	0	and lifting on scribe. Some very small blisters; two medium blisters, moderate corrosion and slight lifting on scribe.	2000
301-103-A	301-234-D	3P	Many very small blisters; some small and two medium blisters, moderate corrosion	2000
301-131-B	301-234-D	0	and slight lifting on scribe. One small blister; one medium blister, slight corrosion and lifting on scribe.	2000
301-103-A 301-131-B	301-204-c 301-204-c	00	ribe.	2000
301-103-A 301-131-B	301-204-E 301-204-E	0 1	Severe cracking Not Tested.	200

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Table 59 (continued)

	Hours Tested	1400	2000
Spray Testing of Epoxy and Silicone-Epoxy Olive Drab Topcoats	Results	Few small blisters; slight discoloration, lifting, and corrosion on scribe. Many small blisters; slight discoloration and corrosion on scribe.	Not Tested. Few very small and one small blister; few small blisters and slight corrosion on scribe.
5% Salt Sp	Adhesion	00	10
	Topcoat Code	301-204-F 301-204-F	301-279-A 301-279-A
	Primer Code	301-103-A 301-131-B	301-103-A 301-131-B

Adhesion Rating System

Description	Excellent Adhesion	Less than 10% failure, primer from substrate	10-25% failure, primer from substrate	25-50% failure, primer from substrate	50-75% failure, primer from substrate	Complete lifting of primer from substrate
	Excellent	Less than substrate	10-25% fa	25-50% fa	50-75% fa	Complete substrate
Rating	0	1.6	2P	3P	4P	5 P
Description	Excellent Adhesion	Less than 10% failure, topcoat from primer	10-25% failure, topcoat from primer	25-50% failure, topcoat from primer	50-75% failure, topcoat from primer	Complete lifting of topcoat from primer
Rating	0	1	2	ო	4	S.

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Table 60

e Topcoats	
White	
e-Epoxy	
Silicon	
y and 5	
of Epox	
Testing (
orrosion	
Bimetallic Corrosion Testing of Epoxy and Silicone-Epoxy	
Bim	

		Dimetality collocial resting of aport and difficult above mile topcoats	
Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A	301-211-K	75% Midland X-4311: 25% Versamid 115	32
301-131-B	301-211-K	75% Midland X-4311: 25% Versamid 115	
301-103-A	301-246-B	75% Midland X-4313: 25% Versamid 115	8 8
301-131-B	301-246-B	75% Midland X-4313: 25% Versamid 115	
301-103-A	301-246-D	75% Midland X-4315: 25% Versamid 115	7 7
301-131-B	301-246-D	75% Midland X-4315: 25% Versamid 115	
301-103-A	301-246-F	75% Midland X-4316: 25% Versamid 115	7 7
301-131-B	301-246-F	75% Midland X-4316: 25% Versamid 115	
301-103-A	301-246-н	75% Midland X-4317: 25% Versamid 115	7 7
301-131-B	301-246-н	75% Midland X-4317: 25% Versamid 115	
301-103-A	301-211-A	90% Epon 1001: 10% Shell H-1	7 7
301-131-B	301-211-A	90% Epon 1001: 10% Shell H-1	
301-103-A	301-211-B	90% Epon 1009: 10% Shell H-1	ოო
301-131-B	301-211-B	90% Epon 1009: 10% Shell H-1	
301-103-A	301-211-C	90% Midland X-4209: 10% Shell H-1	N.T.
301-131-B	301-211-C	90% Midland X-4209: 10% Shell H-1	
301-103-A 301-131-B	301-211-D 301-211-D	90% Dow Corning XR-6-0000: 10% Shell H-1 90% Dow Corning XR-6-0000: 10% Shell H-1	7 7
301-103-A	301-279-B	Shell Eponol H-55.1 - B40	44
301-131-B	301-279-B	Shell Eponol H-55.1 - B40	

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters cr slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	500	500	Less than 500	Less than 500
Rating	0	H	2	e	4	۲۵

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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5% Salt Spray Testing of Epoxy and Silicone-Epoxy White Topcoats

Table 61

			boxy and officene-fpoxy white Topcoats	
Primer Code	Topcoat Code	Adhesion	Results	Hours
301-103-A	301-211-К	3P	Many very small blisters; some small blisters were slight life;	Tested
301-131-B	301-211-K	0	corrosion on scribe. Many very small blisters; slight corrosion on scribe.	2000
301-103-A 301-131-B	301-246-B 301-246-B	00	Many very small blisters; very slight corrosion on scribe. Many very small blisters: slight corrosion on scribe.	2000
301-103-A	301-246-D	0		2000
301-131-B	301246-D	0	corrosion on scribe. Many very small blisters; very slight corrosion on scribe.	2000
301-103-A 301-131-B	301-246-F 301-246-F	00	Many very small blisters; very slight corrosion on scribe. Many very small blisters; slight corrosion on scribe.	2000
301-103-A	301-246-н	m	Many very small blisters; few small blisters elicht liftim	7000
301-131-B	301-246-Н	0	on scribe. Some very small blisters; some small and one medium blister, slight corrosion	2000
301-103-A	301-211-A	c	MALE TO THE TOTAL	
301-131-в	301-211-A	· 0	scribe. Many very small blisters; few small blisters and very slight corrosion on scribe.	2000
301-103-A	301-211-B	0	Many very small blisters; few small blisters of the little	2000
301-131-B	301-211-B	0	slight corrosion on scribe. Many small blisters.	2000
301-103-A 301-131-B	301-211-c 301-211-c	ı 	Not Tested. Some very small blisters; few small blisters, very slight corrosion, slight lifting on scribe.	2000

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Table 61 (continued)

;	Hours	1000	2000
y Testing of Epoxy and Silicone-Epoxy White Topcoats	Results	Many very small blisters, cracking. Few very small blisters; very slight corrosion on scribe.	Not Tested. Many very small blisters; few small blisters, very slight corrosion on scribe.
5% Salt Spray	Adhesion	00	00
22	Topcoat Code	301-211-D 301-211-D	301-279-B 301-279-B
	Primer Code	301-103-A 301-131-B	301-103-A 301-131-B

.

Adhesion Rating System

Description	ilon	Less than 10% failure, primer from substrate	10-25% failure, primer from substrate	25-50% failure, primer from substrate	50-75% failure, primer from substrate	Complete lifting of primer from substrate
	Excellent Adhesion	Less than 10% i substrate	10-25% failure,	25-50% failure,	50-75% failure,	Complete liftin
Rating	0	1.6	2P	3P	4.P	5P
Description	Excellent Adnesion	Less than 10% failure, topcoat from primer	10-25% failure, topcoat from primer	25-50% failure, topcoat from primer	50-75% failure, topcoat from primer	Complete lifting of topcoat from primer
Rating	0	н	7	e	4	S

Section IX

Miscellaneous Primer Work

A. Conventional Primers

It was decided to evaluate some conventional corrosion inhibiting primers under some of the better topcoats.

The following materials were chosen for evaluation:

	Primer Code	Type
1.	40 7	MIL-P-15328
2.	621	TT-E-485d Olive Drab
3.	408	MIL-P-7962
4.	503	MIL-P-11414A

The wash primer, 407, was catalyzed with half the normal acid.

The following olive drab topcoats were used over the conventional primers:

- 1. 301-114-C
- 2. 301-115-A
- 3. 301-134-A
- 4. 301-134-C
- 5. 301-118-F

In general, the performance of coating systems using conventional primers was poor. In the few cases where performance in the bimetallic coupling test was fairly good, the salt spray results were not as good as those obtained when the experimental primers were used. The conventional primers were, therefore, eliminated from additional testing. Bimetallic corrosion and salt spray results are in Tables 62 and 63. (See fig. 9)

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Table 62

Bimetallic Corrosion Testing of Olive Drab Coating Systems Using Conventional Primers

imers	Rating	₩ ₩ ₩ ₩	0 th th 10	v	v 2 2 2	N N N N
Tribers Conventional Primers	Topcoat Vehicle	Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600	Midland R-55: Plaskon ST-847 Midland R-55: Plaskon ST-847 Midland R-55: Plaskon ST-847 Midland R-55: Plaskon ST-847	Midland X-4209: Versamid 115 Midland X-4209: Versamid 115 Midland X-4209: Versamid 115 Midland X-4209: Versamid 115	Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75
	Topcoat Code	301-114-C 301-114-C 301-114-C 301-114-C	301-115-A 301-115-A 301-115-A 301-115-A	301-134-A 301-134-A 301-134-A 301-134-A	301-134-c 301-134-c 301-134-c 301-134-c	301-118-F 301-118-F 301-118-F 301-118-F
	Primer Code	407 621 408 503	407 621 408 503	407 621 408 503	407 621 408 503	407 621 408 503

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	500	200	Less than 500	Less than 500
Rating	0	1	7	m	4	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

) }

Table 63

Primer Code

Hours

Topcoat Code	Adhesion	Results	= HI
			1
301-114-C	0	Many small blisters; corrosion on scribe.	
301-114-C	0	Few small blisters, slight discoloration and corrosion.	
301-114-C	ı	Not Tested.	
301-114-C	0	Slight corrosion; few very small blisters on scribe.	
301-115-A	0	Many small blisters, moderate corrosion, slight lifting, all on scribe.	
301-115-A	2	Many very small blisters, some lifting; very slight corrosion on scribe.	
301-115-A	0	Slight corrosion and lifting on scribe.	
301-115-A	0	Many very small and few small blisters; slight corrosion and lifting on scribe.	
301-134-A	0	Slight lifting; slight discoloration and corrosion on scribe.	
301-134-A	0	Few small blisters; slight discoloration and some corrosion on scribe.	
301-134-A	0	Many very small blisters; some corrosion and very slight lifting on scribe.	
301-134-A	0	Many very small blisters; slight lifting and severe corrosion on scribe.	
301-134-C	0	Two very small blisters; slight corrosion and discoloration on scribe.	
301-134-C	0	Many very small blisters; slight lifting and discoloration on scribe.	
301-134-C	0	Many very small blisters; very slight lifting and corrosion on scribe.	
301-134-C	0	Some very small blisters; slight corrosion and lifting on scribe.	
301-118-F	0	Few very small and many small blisters; slight corrosion and discoloration	
301-118-F	0	Few small blisters: slight corrosion and discoloration on scribe.	
301-118-F	0	Very slight lifting and moderate corrosion on scribe.	
301-118-F	0	Few small blisters; slight lifting and some corrosion on scribe.	

Adhesion Rating System

Description	Excellent Adhesion	Less than 10% failure, primer from substrate	10-25% failure, primer from substrate	25-50% failure, primer from substrate	50-75% failure, primer from substrate	Complete lifting of primer from substrate
Rating	0	1.P	2P	3P	4P	5 P
Description	Excellent Adhesion	Less than 10% failure, topcoat from primer	10-25% failure, topcoat from primer	25-50% failure, topcoat from primer	50-75% failure, topcoat from primer	Complete lifting of topcoat from primer
Rating	0	-	2	3	4	\$

FIG. 9

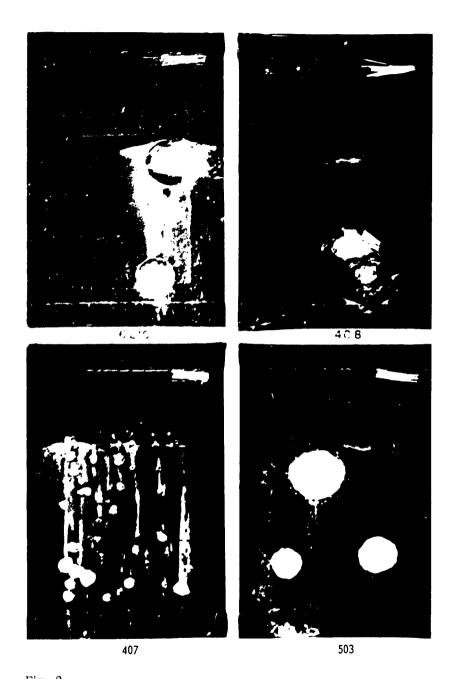


Fig. 9

GALVANIC CORROSION TESTING OF COATING SYSTEMS USING SPECIFICATION PRIMERS.

B. Primers Containing Molybdate Pigments

During the course of the contract, a new series of corrosion inhibiting pigments became commercially available. These materials, made by Mineral Pigments Corporation, are calcium, strontium, and zinc molybdate. While they supposedly do an excellent job in the protection of ferrous substrates, no information was available regarding their effectiveness over magnesium. The following pigments were used:

- 1. 0820 calcium molybdate
- 2. 0830 zinc molybdate
- 3. 0838 strontium molybdate
- 0821 calcium molybdate extended with calcium carbonate
- 5. 0831 zinc molybdate extended with calcium carbonate
- 0839 strontium molybdate extended with calcium carbonate

The vehicles used were:

- 1. Midland R-55: Plaskon ST-847
- 2. Dow Corning XR-6-0000: Versamid 115

Pigment content was varied from 20 to 65% by weight.

It was found that several of these primers, particularly at low pigment loadings, performed well in the bimetallic corrosion test. The salt spray performance of these coatings, however, was extremely poor. The molybdate pigments, rather than having an inhibitory effect on corrosion, actually seemed to promote corrosion. Galvanic corrosion and salt spray testing results of molybdate primers can be found in Tables 64 and 65.

Table 64

Primers	
Molvbdate	
g of	
Testing	
Corrosion	
Bimetallic	

	α Ι	Bimetallic Corrosion Testing of Molybdate Primers	Primers	D	
Primer Code	Primer	er Vehicle	Pigment	Content	Rating
301-250-A 301-250-B 301-250-C 301-250-D	Midland R-55: Plaskon Midland R-55: Plaskon Midland R-55: Plaskon Midland R-55: Plaskon	ST-856 ST-856 ST-856 ST-856	#0820 #0830 #0838 #0821	35% 35% 35%	พพพ
301-250-E 301-250-F	R-55: R-55:	ST.	#0831 #0839	35% 35% 35%	44 M
301-251-B 301-251-C 301-251-D 301-251-E	Dow Corning XR-6-0000:Versamid 115 Dow Corning XR-6-0000: Versamid 1 Dow Corning XR-6-0000: Versamid 1 Dow Corning XR-6-0000: Versamid 1	Versamid 115 Versamid 115 Versamid 115 Versamid 115	#0820 #0820 #0820 #0820	65% 50% 35% 20%	N N 4 W
301-251-G 301-251-H 301-251-J 301-252-A	Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000:	Versamid 115 Versamid 115 Versamid 115 Versamid 115	#0830 #0830 #0830 #0830	65% 50% 35% 20%	งงฅผ
301-252-C 301-252-D 301-252-E 301-252-F	Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000:	Versamid 115 Versamid 115 Versamid 115 Versamid 115	#0838 #0838 #0838 #0838	65% 50% 35% 20%	พพฅผ
301-252-H 301-252-J 301-253-A 301-253-B	Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000:	Versamid 115 Versamid 115 Versamid 115 Versamid 115	#0821 #0821 #0821 #0821	65% 50% 35% 20%	พพพพ
301-253-D 301-253-E 301-253-G	Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000: Dow Corning XR-6-0000:	Versamid 115 Versamid 115 Versamid 115 Versamid 115	#0831 #0831 #0831 #0831	65% 50% 35% 20%	8888

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Table 64 (continued)

Bimetallic Corrosion Testing of Molybdate Primers

Primer Code	Primer Vehicle	Pigment	Pigment	Rating
301-253-J 301-254-A 301-254-B 301-254-C	Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115 Dow Corning XR-6-0000: Versamid 115	#0839 #0839 #0839	65% 50% 35% 20%	บท๓๓
301-258-A	Midland R-55: Plaskon ST-847	#0830	202	4

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	200	500	Less than 500	Less than 500
Rating	0	r-I	2	m	7	۲

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 65

5% Salt Spray Testing of Molybdate Primers

		Hours
Primer Code	Results	Tested
301-250-A 301-250-B 301-250-C	Severely corroded. Severely corroded. Severely corroded on scribe.	120
301-250-D		800
301-250-F	Severely corroded.	007 700
301-251-B	Severely corroded.	77
301-251-C		5.4 2.4
301-251-D	Severely corroded.	100
301-251-Е	Severely corroded.	200
301-251-G	Severely corroded.	76
301-251-н	Severely corroded.	24
301-251-J	Severely corroded.	77
301-252-A	Severely corroded.	24
301-252-C	Severely corroded.	7.7
301-252-D	Severely corroded.	* 84 84
301-252-E	Severely corroded,	96
301-252-F	Severely corroded.	360
301-252-н	Severely corroded.	76
301-252-J	Severely corroded,	77
301-253-A	Severely corroded.	87
301-253-B	Many small and few medium blisters; severe corrosion on scribe.	1000
301-253-D	Severely corroded.	7.7
301-253-E	Severely corroded.	54
301-253-F	small blisters and severe corrosion on scribe.	
301-223-6	Some medium blisters, moderate corrosion, and lifting, all on scribe.	

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Table 65 (continued)

5% Salt Spray Testing of Molybdate Primers

Hours Tested	120 120 1200 0e.1400	120
Results	Severely corroded. Severely corroded. 120 Many very small blisters, slight corrosion and lifting on scribe. Some very small and many small blisters, moderate corrosion on scribe.1400	Severely corroded.
Primer Code	301-253-J 301-254-A 301-254-B 301-254-C	301-258-A

Although the salt spray performance of the molybdate primers was poor, it was decided to try a few of them under some of the better topcoats. The following were chosen:

- 1. 301-252-F
- 2. 301-253-B
- 3. 301-253-G

Topcoats used for this program were:

- 1. 301-118-F
- 2. 301-175-B
- 3. 301-114-C
- 4. 301-134-A
- 5. 301-204-A
- o. 301-163-B (white)

The coating systems using the molybdate primers were fair in the bimetallic corrosion test but performed poorly in the salt spray. These primers were eliminated from further testing. Galvanic corrosion and salt spray results can be found in Tables 66 and 67.

- C. Comparison of Zinc Chromate Pigments from Various Suppliers

 Midland R-55: Plaskon ST-847 primers were made from zinc

 chromate pigments obtained from the following suppliers:
 - 1. Imperical Color, Chemical & Paper Corp.
 - 2. Reichhold Chemicals, Inc.
 - 3. Western Dry Color Company

- 4. Kentucky Color & Chemical Company
- 5. DuPont

Bimetallic corrosion tests performed on panels coated with these primers indicated no substantial differences in these pigments as far as their performance in this coating was concerned.

Table 66

Bimetallic Corrosion Testing of Coating Systems Using Molybdate Primers

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	200	200	Less than 500	Less than 500
Rating	0	1	2	e	4	5

N.T. - Not tested due to cracking or other film fallure.

G - Coating gelled during preparation.

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Table 67

5% Salt Spray Testing of Coating Systems Using Molybdate Primers

			But II man d'ann d'ann d'ann d'ann d'ann de la commande de la comm	
Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-252-F	301-118-F	Not tested	Some very small blisters, severely corroded.	1000
301-253-B	301-118-F	Not tested	Many small blisters, severely corroded.	1200
301-253-G	301-118-F	Not tested	Few very small blisters, severely corroded.	1200
301-252-F	301-175-B	Not tested	Some very small blisters, severely corroded. Some very small blisters, severely corroded. Some very small blisters, severely corroded.	1200
301-253-B	301-175-B	Not tested		1200
301-253-G	301-175-I	Not tested		1200
301-252-F	301-114-C	Not tested	Sany small and few medium blisters.	00 7
301-253-E	301-114-C	Not tested	Jany small and very small blisters.	00 9
301-253-G	301-114-C	Not tested	Jany small blisters.	007
301-252-F	301-134	Not tested	hany very small clisters, severely corroded. Many very small blisters, severely corroded. Many very small blisters, severely corroded.	1000
301-253-b	301-134-A	Not tested		1000
301-253-G	301-134-A	Not tested		1000
301-252-F	301-204-A	Not tested	Many very small blisters, severely corroded. Many very small blisters, severely corroded. Many very small blisters, severely corroded.	1000
301-253-B	301-204-A	Not tested		1000
301-253-G	301-204-A	Not tested		1000
301-252-F	301-163-B	Not tested	Severely corroded.	1000
301-253-B	301-163-B	Not tested	Some very small blisters, severely corroded.	1000
301-253-G	301-163-B	Not tested	Severely corroded.	1000

D. Effect of Extender Pigments on Primer Performance

Earlier in the contract, small amounts of extender

pigments were added to some primers to determine the

effect of the inerts on bimetallic corrosion resist
ance. No topcoats were used. The primers contain-

ing the inert pigments were far inferior in performance

to the same coatings without the inerts.

It was believed worthwhile testing the two best primers, with and without extender pigments, under some of the better topcoats. The following primers were used:

- 1. 301-103-A zinc chromate primer
- 2. 301-124-H zinc chromate primer with extender pigments
- 3. 301-131-B calcium chromate primer
- 4. 301-232-H calcium chromate primer with extender pigments

The first two primers above have Midland R-55:

Plaskon ST-847 as the vehicle while the other

remaining two coatings contain a Dow Corning XR-6-0000:

Versamid 115 vehicle. The following topcoats were

used over each primer:

- 1. 301-115-A
- 2. 301-134-A
- 3. 301-175-A
- 4. 301-175-C
- 5. 301-222-A
- 6. 301-183-B (white)

The results of the testing of this series are very similar to those obtained when only the primers were tested, namely, systems using primers containing no extender pigments performed much better than systems using primers with inert pigments. Results of salt spray and bimetallic corrosion testing can be found in Tables 68 and 69. (See fig. 10)

E. Effect of Tri-butyl Tin Oxide on Galvanic Corrosion Resistance

Tri-butyl tin oxide supposedly has an inhibitory effect on the corrosion of magnesium. Small amounts of TBTO were, therefore, added to the 301-131-B calcium chromate primer. Similar additions of TBTO to the 301-103-A zinc chromate primer produced incompatibility and gelation. The results of the testing of coatings containing TBTO seem to indicate that for this particular coating, the addition of TBTO accelerates rather than inhibits corrosion. Salt spray and bimetallic corrosion results are listed in Tables 70 and 71.

Table 68

Bimetallic Cor

	bimetallic	Corrosion Testin	bimetallic Corrosion Testing of Coating Systems Using Primers Containing Extender Diagrams	
Primer Code	Topcoat Code		Topcoat Vehicle	
301-103-A 301-124-H	301-115-A 301-115-A	Midland R-55: Midland R-55:	Plaskon ST-847 0 0	Na H
301-131-B 301-232-H	301-115-A 301-115-A	Midland R-55: Midland R-55:	Plaskon ST-847 Plaskon ST-847	_
301-103-A 301-124-H	301-134-A 301-134-A	Midland X-4209: Midland X-4209:): Versamid 115): Versamid 115	
301-131-B 301-232-H	301-134-A 301-134-A	Midland X-4209: Midland X-4209:	Versamid 115 Versamid 115	
301-103-A 301-124-H	301-175-A 301-175-A	Midland X-4263 Midland X-4263) II (
301-131-B 301-232-H	301-175-A 301-175-A	Midland X-4263 Midland X-4263	t mx	
301-103-A 301-124-H	301-175-C 301-175-C	Midland X-4271 Midland X-4271	† 8×	
301-131-в 301-232-н	301-175-C 301-175-C	Midland X-4271 Midland X-4271	7 00 6	
301-103-A 301-124-H	301-222-A 301-222-A	Midland X-4300 Midland X-4300	n 04.6	
301-131-B 301-232-H	301-222-A 301-222-A	Midland X-4300 Midland X-4300	2 2 3	

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Table 68 (continued)

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- COITOSION LESTING OI COATING Systems Using Primers Containing Extender Ploments	cle		
Ing of Coating Systems	Topcoat Vehicle	Epon 1001: Dow Corning 2-6020 Epon 1001: Dow Corning 2-6020	: Dow Corning Z-6020 : Dow Corning Z-6020
DIMECALITY COLLOSION LES		Epon 1001: Epon 1001:	Epon 1001: Epon 1001:
	Topcoat Code	301-183-B 301-183-B	301-183-B 301-183-B
	Primer Code	301-103-A 301-124-H	301-131-B 301-232-H

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	900	500	500	200	Less than 500	Less than 500
Rating	0	1	2	က	4	S

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 69

5% Salt Spray Testing of Coating Systems
Using Primers Containing Extender Pigments

Primer Code	Topcoat Code	Adhesion	Results	Hours Tested
301-103-A	301-115-A	5	Slight corrosion and one medium blister on scribe.	2000
♥ J1-124-H	301-115-A	. 3	One medium and few small blisters, slight lifting and moderate corrosion, all on scribe	2000
301-131-B	301-115-A	. 2	Very slight lifting on scribe.	2000
301-232-H	301-115-A	. 0	Few small and one medium blister, slight lifting and corrosion, all on scribe.	2000
301-103-A	301-134-A	. 0	Few small blisters and slight lifting on scribe.	2000
301-124-H	301-134-A	0	Some very small blisters; one medium blister, moderate corrosion and slight lifting on scribe.	2000
301-131-B	301-134-A	0	Very slight lifting and few very small blisters on scribe.	2000
301-232-H	301-134-A	. 0	Some very small blisters; two medium blisters, slight corrosion and lifting on scribe.	2000
301-103-A	301-175-A	. 5	Slight corrosion on scribe.	2000
301-124-H	301-175-A	0	Many small blisters, slight corrosion and lifting, all on scribe.	2000
301-131-B	301 - 175-A	. 1	Few very small blisters and slight corrosion on scribe.	2000
301-232-H	301-175-A	. 0	Few small and one medium blister, slight corrosion and lifting, all on scribe.	2000
301-103-A	301-175-C	5	Slight lifting and corrosion on scribe.	2000
301-124-H	301-175-C	3	Two medium blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-131-B	301 - 175-C	5	Two small blisters, very slight lifting and corrosion, all on scribe.	2000
301-232-H	301-175-C	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	2000
301-103-A	301-222-A	. 5	Very few small blisters and slight corrosion on scribe.	2000
301-124-H	301-222-A	. 1	Slight corrosion and lifting on scribe.	2000
301-131-B	301-222-A	. 5	Few small and one medium blister, slight lifting and corrosion, all on scribe.	2000
301-232-H	301-222-A	. 0	Few small blisters, slight lifting and corrosion, all on scribe.	2000

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Table 69 (continued)

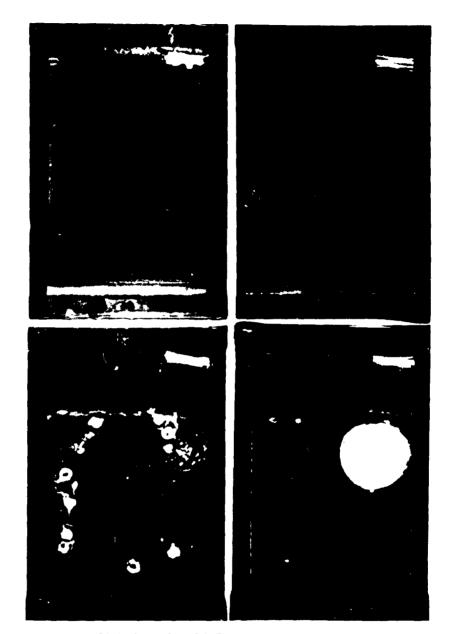
5% Salt Spray Testing of Coating Systems Using Primers Containing Extender Pigments

	Primer Code	Topcoat Code Adhesio	n Results	Hours Tested
	301-103-A	301-183-B 1	Completely unaffected.	2000
•	301-124-H	301-183-B 0	Few small blisters; slight lifting and very slight corrosion on scribe.	2000
	301-131-B	301-183-B 0	Very slight corrosion on scribe.	2000
	301-232-H	301-183-B 0	Few very small blisters; many very small	2000

Adhesion Rating System

Decortorio	Excellent Adhesion	Less than 10% failure, primer from substrate	10-25% failure, primer from substante	25-50% failure, primer from substrate	50-75% failure, primer from substrate	Complete lifting of primer from substrate
Rating	0	1.	2P	3P	4Þ	5P
Description	Excellent Adhesion	Less than 10% failure, topcoat from primer	10-25% failure, topcoat from primer	25-50% failure, topcoat from primer	50-75% failure, topcoat from primer	Complete lifting of topcoat from primer
Rating	0	H	7	ო	4	ۍ

FIG. 10



RESULTS OF ADDING INERT PIGMENTS TO PRIMERS C = INERTS ADDED A = WITHOUT

Fig. 10

EFFECT OF ADDITION OF INERT PIGMENT TO PRIMERS OF PREFERRED COATING SYSTEMS

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Table 70

Effect of Tributyl Tin Oxide on Bimetallic Corrosion

Primer Code	Vehicle		% TBTO Based on Total Weight	Rating
301-131-B	Dow Corning XR-6-0000: Versamid 115	Versamid 115	0	2
301-267-E	Dow Corning XR-6-0000: Versamid 115	Versamid 115	1	2
301-267-F	Dow Corning XR-6-0000: Versamid 115	Versamid 115	2	က
301-267-G	Dow Corning XR-6-0000: Versamid 115	Versamid 115	5	က
301-267-н	Dow Corning XR-6-0000: Versamid 115	Versamid 115	10	ဧ

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	500	500		500	Less than 500	Less than 500
Rating	0	1	2	m	4	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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Table 71

5% Salt Spray Testing of Primers Containing Tributyl Tin Oxide

Primer Code	Results	Hours Tested
301-131-B	Few very small and some small blisters.	2000
301-267-E	Some small blisters and slight corrosion on scribe.	2000
301-267-F	Many small blisters and slight corrosion on scribe.	2000
301-267-G	Some very small blisters; slight corrosion on scribe.	2000
301-267-н	One small and some very small blisters; many small blisters and slight corrosion on scribe.	2000

F. Evaluation of Previously Eliminated Primers

Since all evaluation of complete coating systems had .

been conducted using only two primers, it was decided to test some of the better topcoats over some previously eliminated primers. It was also decided to include some of the primers which were developed later in the contract and never tested under topcoats. The primers chosen for this study were:

	Primer Code	Vehicle	Pigment
1.	301-106-A	Epon 1001: Versamid 115	ZnCr0 ₄
2.	301-106-G	Epon 1001: Versamid 115	CaCr0 ₄
3.	301-106-К	Epon 1001: Diethylene Triamine	CaCr0 ₄
4.	301-107-A	Epon 1009: Versamid 115	ZnCr0 ₄
5.	301-102-D	Kel F Fluorel: Acryloid A-101	ZnCr0 ₄
6.	301-158-L	Midland X-4245	ZnCr0 ₄
7.	301-159-D	Midland X-4271	ZnCr0 ₄
8.	301-188-C	Epon 1001: Snell H-1	CaCr0 ₄
9.	301-202-A	Midland X-4283	ZnCr04
10.	301-158-C	Midland X-4240	CaCr0 ₄
11.	301-159-G	Midland X-4282	ZnCr0 ₄
12.	301-232-Е	Midland X-4316: Versamid 115	CaCr04

The topcoats used were:

- 1. 301-175-B Olive Drab
- 2. 301-118-F Olive Drab
- 3. 301-114-C Olive Drab
- 4. 301-134-A Olive Drab
- 5. 301-134-C Olive Drab
- 6. 301-163-B White

As usual, both bimetallic corrosion and salt spray resistance of these coating systems was determined.

All of these systems, as can be seen from Tables 72 and 73, were inferior to the best coating systems and were eliminated from further consideration.

74mmmmm4mH07

CB-75 CB-75

Mondur Mondur

R-16: R-16: R-16: R-16:

Multron

Corning Corning Corning

Multron Multron Multron

Mondur Mondur

Multron

Multron

CB-75 CB-75

Mondur Mondur

Bakelite BRS-2600 Bakelite BRS-2600 Bakelite BRS-2600

Corning R-6-0031:

Dog Dog Dog Dow Dow

Corning R-6-0031: Corning R-6-0031:

301-114-C

301-114-C 301-114-C

301-114-C 301-114-C

R-6-0031:

Corning

R-6-0031:

Corning

301-232-E

301-106-A 301-106-G 301-106-K 301-107-A 301-102-D 301-158-L

Bakelite BRS-2600 Bakelite BRS-2600

BRS-2600

Bakelite

R-6-0031:

Corning

R-6-0031:

Corning

CB-75 CB-75 CB-75 CB-75 CB-75

Mondur Mondur

Mondur

Mondur

R-16: R-16: R-16:

Multron Multron Multron

Corning R-6-0031:

R-6-0031: R-6-0031:

Corning Corning Corning

Рοм Dog Dog Dog Dow Dow Dog Dog Dow Dow Dow Dog

301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-118-F 301-114-C

301-107-A 301-102-D

301-158-L 301-159-D 301-188-C 301-158-C 301-159-G 301-202-A

CB-75 CB-75 CB-75

Mondur

Mondur

R-16: R-16: R-16: R-16:

R-16:

Multron Multron Multron

R-6-0031: R-6-0031:

R-6-0031:

Corning

Corning

R-6-0031: R-6-0031; R-6-0031: R-6-0031: R-6-0031:

Corning Corning 50000

Bimetallic Corrosion Testing of Coating Systems Using Previously Eliminated Primers

Table 72

Topcoat Vehicle

R-55 R-55

301-175-B 301-175-B 301-175-B 301-175-B

301-175-B

301-107-A

301-102-D 301-158-L

301-106-G 301-106-K

301-106-A

301-159-D

301-188-C 301-202-A

301-159-G

301-106-A 301-106-G 301-106-K

301-175-B 301-175-B 301-175-B 301-175-B

301-175-B

Midland Midland Midland Midland Midland Midland Midland Midland Midland Midland

Topcoat Code

Primer Code

R-55 R-55 R-55

R-55 R-55 R-55 R-55

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Table 72 (continued)

etallic Corrosion Testing of Coating Systems Using Previously Eliminated Primers

	Bimetallic Corrosic	Bimetallic Corrosion Testing of Coating Systems Using Heyrogary	
•		Topcoat Vehicle	Rating
Primer Code	Topcoar one		•
	201-116-0	Now Corning R-6-0031: Bakelite BRS-2600	n 4
301-129-0	201-114	Corning R-6-0031: Bakelite	٠ ٠
301-188-C	30T-TT#-C	Corporate	\$ (
301-202-A	301-114-C	COLUMN COOST: Dabolito	7
301-232-E	301-114-C	Daketice	•
		visita v-6200. Versamid 115	(1)
301-106-A	301-134-A		m
301-106-G	301-134-A	X-4209: Versamto	ب
301-106-K	301-134-A	X-4209: Versamia	4
301-102-A	301-134-A	X-4709: Versamia	67
N- 101-100	301-134-A	Midland X-4209: Versamid 115	. ~
301-105	1 701 100	Midland Y-6709: Versamid 115) (
301-158-L	301-134-A	Control of the state of the sta	~
301-159-D	301-134-A	X-4209: Versamin	4
C-33E FOC	301-134-A	Versamid	~
2-00T=TOC	4 701 100	Midland X-4209: Versamid 115	, (
301-202-A	301-134-A	v / 200: Versamid	7
301-158-C	301-134-A	STATE OF THE STATE	7
201-159-G	301-134-A	X-4209: Versamia	7
	201-126-A	Midland X-4209: Versamid 115	
301-232-E	W_+CT_TOC	!	
	70.	Doe Corning XR-6-0000: Versamid 115	·) ·
301-106-A	301-134-0		4
301-10e-G	301-134-C	COLUMN AN-0-0000: VELSCONIES	Ś
301-106-K	301-134-C	XR-6-0000: Versamia	4
301-105	301-134-C	XR-6-0000: Versamid	· cr
	301-134-C		• •
301-105	201-106	Dow Corning XR-6-0000: Versamid 115	•
301-158-L	ついてしていて	011110	‡
301-159-D	301-134-C	COLUMN AN-0-0000. Versamina	4
301-188-C	301-134-C	Corning AK-6-0000: Versamid	m
201 -202-A	301-134-C	XR-6-0000: Versamia	-
201-106	301-134-C	Versamid	۰ د
301-130-0	301-134-C	Dow Corning XR-6-0000: Versamid 115	
301-132-6			

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Table 72 (continued)

Bimetallic Corrosion Testing of Coating Systems Using Previously Eliminated Primers

Rating	หลาย เมื่อเลือ
Bimetallic Corrosion Testing of Coating Systems Corros Topcoat Vehicle	Topcoat Code 301-163-B
	301-106-A 301-106-A 301-106-G 301-106-K 301-102-D 301-158-L 301-158-D 301-188-C

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	500	500	Less than 500	Less than 500
Rating	0	1	2	ဧ	4	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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Elimina
Previously
Systems Using
f Coating
pray Testing of Coati
Salt S
2%

Trimer cone	Topcoat Code	Adnesion	Results	Tested
301-106-A	301-175-B	0	Some very small blisters; one medium blister and slight corrosion on scribe.	2000
301-106-G	301-175-B	0	Some very small blisters; one medium blister and slight corrosion on scribe.	2000
301-106-K	301-1/5-B	0	few	2000
301-107-A	301-175-B	2P	one	2000
			and lifting on scribe.	
301-102-D	301-175-B	0	Many very small and some small blisters; slight corrosion on scribe.	2000
301-158-L	301-175-B	0	Many very small blisters; one medium blister and moderate corrosion on scribe.	2000
301-159-D	301-175-B	0	Many very small and some small blisters; some small blisters, slight corrosion	2000
,			and lifting on scribe.	
301-188-C	301-1;5-b	0	Many very small blisters; some small blisters, slight corrosion and lifting on	2000
301-202-A	301-175-B	0	Many very small blisters: few small blisters and slight corrosion on scribe	0000
301-159-G	301-175-B	0	One small blister, moderate corrosion, slight lifting, all on scribe.	2000
	•	,		
301-106-A	301-118-F	1P	Some very small blisters; few small blisters, slight corrosion and lifting on	2000
	,		scribe.	
301-106-G	301-118-F	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-106-K	301-118-F	1.		2000
301-107-A	301-118-F	0		2000
301-102-D	301-118-F	0	small blisters;	2000
301-158-L	301-118-F	0	small blisters: few	
301-159-D	301-118-F	5	small blisters:	
301-188-C	301-118-F	0	small blisters: few	2002
301-202-A	301-118-F	0	small blisters: few small blisters, and slight corrosion on ecribe	
301-158-C	301-118-F	'n	small blisters:	0000
301-159-G	301-118-F	0	Few small blisters, slight corrector, elicht lifting on earth	0000
1 000			controlly stabile tartaile on settoe.	

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Table 73 (continued)

Primers	
Eliminated	
Previously	
Using	
Systems	
Coating	
of	
Testing	
Salt	
5%	

Tested	007 007 007	2000 400 2000	400 2000 2000	scribe. 2000 2000	e. 2000 2000	scribe. 2000 2000	scribe. 2000 scribe. 2000 n and 2000	2000 2000 scribe. 2000
Results	Many small and very small blisters; slight corrosion on scribe. Many small and very small blisters. Many small and very small blisters; slight corrosion on scribe. Many small and very small blisters; slight corrosion on scribe.	Many small and very small blisters; slight corrosion on scribe. Many very small blisters; slight corrosion on scribe. Many very small blisters; few small and two medium blisters, slight corrosion on scribe.		Some very small blisters; few small blisters, slight corrosion and lifting on scribe. Many very small blisters; few small and medium blisters, slight corrosion and lifting on scribe.	Many very small and few small blisters; slight corrosion and lifting on scribe. Few very small blisters; few small and medium blisters, slight corrosion and lifting on scribe.	Many very small blisters; few small blisters, slight corrosion and lifting on scribe. Many very small blisters; few small and medium blisters, slight corrosion and lifting on scribe.	Some very small blisters; few small blisters, slight corrosion and lifting on scribe. Many very small blisters; few small blisters, slight corrosion and lifting on scribe. One medium and many very small blisters; many small blisters, slight corrosion and lifting on scribe.	Some very small blisters; slight corrosion and lifting on scribe. Many very small blisters; slight lifting and moderate corrosion on scribe. Few very small blisters; two medium blisters, slight corrosion and lifting on scribe.
Adhesion	0 0 2P	000	000	o o	3P 3P	00	000	000
Topcoat Code	301-114-C 301-114-C 301-114-C 301-114-C	301-114-C 301-114-C 301-114-C	301-114-C 301-114-C 301-114-C	301-134-A 301-134-A	301-134-A 301-134-A	301-134-A 301-134-A	301-134-A 301-134-A 301-134-A	301-134-A 301-134-A 301-134-A
Primer Code	301-106-A 301-106-G 301-106-K 301-107-A	301-102-D 301-158-L 301-159-D	301-188-C 301-202-A 301-232-E	301-106-A 301-106-G	301-106-K 301-107-A	301-102-D 301-158-L	301-159-D 301-188-C 301-202-A	301-158-C 301-159-G 301-232-E

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Table 73 (continued)

Primers	
Eliminated	
Previously	
Using	
Systems	•
Coating	,
of	
Testing	1
Spray	
Salt	
2%	

	Topcoat Code	Adhesion	Results	Tested
301-106-A	301-134-C	0	Some very small blisters; few small blisters and slight corrosion on scribe.	2000
301-106-G	301-134-C	0	Many very small blisters; few small blisters and slight corrosion on scribe.	
301-106-K	301-134-C	0	Many very small blisters; few small blisters, slight corrosion and Mfting on scribe.	
301-107-A	301-134-C	1.	Few very small blisters; few small blisters, slight corrosion and lifting on scribe.	
301-102-D	301-134-C	0	Many very small blisters; few small blisters, slight corrosion and lifting on scribe.	se. 2000
301-128-L	301-134-C	0	Many very small blisters; one medium and few small blisters, slight corrosion and	2000
			lifting on scribe.	
301-159-D	301-134-C	0	Some very small blisters; one medium and few small blisters, slight corrosion and lifting on scribe.	2000
301-188-C	301-134-C	0	Few small blisters; few small blisters, slight lifting and corrosion on scribe.	2000
301-202-A	301-134-C	0	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-158-c	301-134-C	0	Some very small blisters; slight corrosion and lifting on scribe.	2000
301-159-G	301-134-C	0	Many very small and one medium blister; slight lifting and moderate corrosion on	2000
			scribe.	
1 701 100	4 671 106	c	Dos. omell blintenes and alicht commenter or sentite	0000
301-106	301-103-D	> <	Norw upon a min stight country of the country of th	2000
3-001-106	301-163-B	o	imily very smart interests, origin tollowing in stilling. Many vory small and few small blictore: elight correction on enrish	2002
301-107-A	301-163-B	4P	Many very small blisters; few small blisters and slight corrosion on scribe.	2000
301-102-D	301-163-B	•	Not Tested.	ı
301-158-L	301-163-B	ı	Not Tested.	
301-159-D	301-163-B		Not Tested.	•
301-188-C	301-163-B	0	Many very small and few small blisters; slight corrosion on scribe.	2000
301-202-A	301-163-B	1	Not Tested.	•

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Adhesion Rating System

		cimer from	rom substrate	rom substrate	rom substrate	er from
Description	Excellent Adhesion	Less than 10% failure, primer from substrate	10-25% failure, primer from substrate	25-50% failure, primer from substrate	50-75% failure, primer from substrate	Complete lifting of primer from substrate
Rating	0	11b	2P	3P	4P	5.P
Description	Excellent Adhesion	Less than 10% failure, topcoat from primer	10-25% failure, topcoat from primer	25-50% failure, topcoat from primer	50-75% failure, topcoat from primer	Complete lifting of topcoat from primer
Rating	0	Ħ	7	ന	4	٧.

G. Primers Containing Miscellaneous Vehicles

During the course of the contract, a number of miscellaneous vehicles were tested. Some of these materials passed initial screening tests in clear films and were incorporated into primers. These resin systems were:

- 1. Midland X-3928 a silicone copolymer.
- Dow Corning R-6-0031: Mondur CB-75 This
 vehicle is the same as one of the better vehicles
 but the Multron R-16 polyester was eliminated.
- 3. Midland X-4415 a silicone copolymer.
- 4. Midland X-4323 a silicone copolymer.
- 5. ADM Aroflint 202-XA1-60: 303-X-90.
- 6. Cargill 1459 Polyurethane Oil.
- 7. Midland X-3934 a urethane prepolymer.

None of these primers were considered good enough to warrant further investigation. Bimetallic corrosion and salt spray results can be found in Tables 74 and 75.

H. Reformulation of 301-131-B Primer

One of the problems with the 301-131-B primer was the extremely hard settling of the pigment. A small amount of Bentone 27 was added to correct this condition. The code for the reformulated primer was 301-271-D.

It was then discovered that the General Electric SR-82 which was added as a flow control agent was absorbed by the pigment, eventually causing a flow problem.

This was corrected by putting the SR-82 into the catalyst system. The code for the final revised formula is 301-275-E. No change in performance of the primer was noticed as these changes were made.

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Table 74

Bimetallic Corrosion Testing of Primers Using Miscellaneous Vehicles

Primer Code	Primer Vehicle	Pigment	Ratino
301-203-н	Midland X-3928	Zinc Chromate	7
301-233-B	Dow Corning R-6-0031: Mondur CB-75	Zinc Chromate	m
301-274-D	Cargill 1459 Polyurethane Oil	Zinc Chromate	ოო
301-274-E	Cargill 1459 Polyurethane Oil	Calcium Chromate	
301-321-B	Midland X-4415	Zinc Chromate	ო ო
301-321-C	Midland X-4415	Calcium Chromate	
301-348-C	Midland X-4323: Midland X-3934	Zinc Chromate	.
301-348-D	Midland X-4323: Midland X-3934	Calcium Chromate	
301-348-E	Midland X-4323: Mondur CB-75	Zinc Chromate	m m
301-348-F	Midland X-4323: Mondur CB-75	Calcium Chromate	
301-434-D	Aroflint 202-XA1-60: Aroflint 303-X-90	Calcium Chromate	'n

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	500	500	Less than 500	Less than 500
Rating	0	-	2	e	4	S

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

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Table 75

5% Salt Spray Testing of Primers Using Miscellaneous Vehicles

Primer Code	Results	Hours Tested
301-203-н	Many very small blisters and slight corrosion.	800
301-233-B	Some small blisters; many small blisters and slight corrosion on scribe.	2000
301-274-D 301-274-E	Many small and very small blisters, some corrosion. Some very small blisters; slight corrosion on scribe.	400
301-321-В	Many very small and some small blisters; slight corrosion on	2000
301-321-C	Many very small and some small blisters; slight corrosion on scribe.	2000
301-348-C 301-348-D	Many very small blisters, slight corrosion. Some small and very small blisters; slight corrosion on scribe.	2000
301-348-E 301-348-F	Many small and very small blisters; slight corrosion on scribe. Some very small blisters; some small blisters and slight corrosion on scribe.	2000
301-434-D	Some small and very small blisters, slight corrosion.	2000

Section X

Miscellaneous Olive Drab Topcoat Work

A. Reformulation of Olive Drab Topcoats to Match
Color #X-24087.

During the course of the contract, it was decided the color of the olive drab topcoat should match color chip #X-24087 rather than #2430. This color was obtained by deleting the titanium dioxide from the original pigmentation and shading the resulting color. The formula codes for the shaded systems are as follows:

#2430	<u>#x-24087</u>
301-114-C	301-264-в
301-175-B	301-270-C
301-118-F	301-284-D
301-134-A	301-278-E
301-134-C	301-278-C

In addition to matching the new color, these formulations were corrected to the proper gloss.

B. Corrosion Resistance of Reformulated Olive Drab Topcoats

It was decided to compare the reformulated topcoats

with the original coatings. In addition, the effect

of some variations in pigment volume concentration were

evaluated. The coatings tested and their variables

were:

		R-6-0031 Multron R-16 Mondur CB-75	Midland R-55	R-6-0031 BRS-2600
l.	Original PVC, color #2430	301-118-F	301-175-В	301-114-C
2.	Original PVC, color #X-24087	301-312-D	301-314-A	301-315-A
3.	Original PVC, color #X-24087, without inert pigments	301-313-В	301-314-В	301-315-В
4.	New PVC, color #2430	301-312-В	301-313-C	301-314-C
٥.	New PVC, color #X-24087	301-284-D	301-270-C	301-264-B

It can be seen from Table 76 that there was very little change in galvanic corrosion resistance when the olive drab coatings were reformulated.

At the time of this test, it was noted that there was considerable variation in the appearance of the Dow 17 treated panels. Some of the panels had a uniform appearance while others looked spotty. Each of these coatings was tested on both types of substrate. Neither substrate was consistently better than the other. No salt spray tests were performed.

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Table 76

Bimetallic Corrosion Testing of Reformulated Olive Drab Topcoats

Rating	77777	77177	00000	нанан
Topcoat Vehicle	Midland R-55 Midland R-55 Midland R-55 Midland R-55 Midland R-55	Midland R-55 Midland R-55 Midland R-55 Midland R-55 Midland R-55	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75
	Midla Midla Midla Midla	Midly Midly Midly Midly	Dow Dow Dow	Dow Dow Dow
Topcoat Code	301-175-B 301-314-A 301-314-B 301-313-C 301-270-C	301-175-B 301-314-A 301-314-B 301-313-C 301-270-C	301-118-F 301-312-D 301-313-B 301-312-B 301-284-D	301-118-F 301-312-D 301-313-B 301-312-B 301-284-D
Primer Code	301-103-A 301-103-A 301-103-A 301-103-A 301-103-A	301-275-E 301-275-E 301-275-E 301-275-E	301-103-A 301-103-A 301-103-A 301-103-A	301-275-E 301-275-E 301-275-E 301-275-E 301-275-E

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Table 76 (continued)

Bimetallic Corrosion Testing of Reformulated Olive Drab Topcoats

Rating	H mmzmm	44 × 44 × 44 × 44 × 44 × 44 × 44 × 44
Topcoat Vehicle	Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600	Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600 Dow Corning R-6-0031: Bakelite BRS-2600
Topcoat Code	301-114-C 301-315-A 301-315-B 301-314-C 301-264-B	301-114-C 301-315-A 301-315-B 301-314-C 301-264-B
Primer Code	301-103-A 301-103-A 301-103-A 301-103-A 301-103-A	301-275-E 301-275-E 301-275-E 301-275-E 301-275-E

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	900	Less than 500	Less than 500
Rating	0		2	m	7	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

C. Alternate Olive Drab Pigmentation

An alternate form of pigmentation was tried using the Midland R-55: Plaskon ST-847 vehicle. The following pigment system was used:

Graphite	17.4%
Mapico #20	17.7%
Cadmium lithopone	24.7%
Talc	40.2%
	100 0%

Coatings with pigment contents of 40 and 60% were evaluated. Since no improvements were gained using this pigmentation, the original pigment system was used for the remainder of the contract.

D. Addition of Wax to Olive Drab Topcoats

Since wax had been so effective in preventing corrosion of the edges of the panels, it was decided to add some wax to the olive drab topcoats. Petrolatum and spermaceti were the waxes used. The coatings containing the waxes were no better in corrosion resistance, and in most cases worse, than the coatings without wax. A coating of wax was applied over some of the coating systems, also. Unless the wax was applied in a very heavy coat, no improvements were seen.

E. Silane Treatment of Olive Drab Pigments

Since most of the problems encountered during the duration of this contract were galvanic corrosion failures, it was decided to try to stop the electrolyte from connecting the anode and cathode electrically. If this could be accomplished, the galvanic cell would be short circuited and no galvanic corrosion could occur. It was believed the electrolyte either penetrated the paint film by wick action directly through pigment particles or penetrated through the pigmentresin interface. The latter was probably a weak link since the organophobic nature of most pigments prevents their surfaces from being properly wetted by resins. If either of these conditions was responsible for the generally poor galvanic corrosion resistance shown by most coating systems, the problem theoretically could be solved by making the pigment surfaces more organophilic. One way of doing this is by treating the pigments with silanes.

If a pigment is properly treated with a silane, its surface will become extremely water repellent. Based on the surface area of a pigment, enough silane is used to provide a monomolecular layer. The silane reacts chemically with the pigment, orienting itself with the organic portion of it outward, presenting a hydrophobic, organophilic surface.

The following procedure was used to treat all pigments:

1. The amount of silane necessary to treat each pigment was calculated. Lampblack, for example, with a surface area of 38 square meters per gram would require 0.095 grams of Union Carbide A-154 to provide a monomolecular layer of silane. This figure was based on the silane supplier's figure of 400 square meters per gram of A-154 silane.

- 2. The moisture content of each pigment was adjusted by adding water or ammonium hydroxide (as recommended by the silane supplier). The water (or ammonium hydroxide) was theroughly distributed throughout the pigment by placing the wetted pigment in a can and tumbling for several hours on pebble mill rollers.
- 3. The necessary amount of silane was then added and the container was tumbled an additional 4 hours.
- 4. The pigment was removed from the can and air dried. Pigment treated with A-154 was dried at 300°F for 1 hour to remove as much excess hydrochloric acid as possible.
- 5. A small amount of the treated pigment was tested for wettability by stirring in a beaker of water. Only pigment not wetted by water was used.

Five silanes, Union Carbide's A-154 (methyltrichlorosilane), A-162 (methyltriethoxysilane), Y-2525 (vinyltrimethoxysilane), Y-2815 (amyltrimethoxysilane), and Dow Corning Sylkyd 50, were evaluated. The A-154 silane reacted faster and more efficiently than the other materials but the HCl liberated reacted with some of the pigments and changed their color. The other materials caused no undesirable changes in color but reacted very slowly.

The treated pigments were used to prepare olive drab topcoats. These materials were applied over primers and evaluated for resistance to galvanic corrosion. All topcoats prepared from silane-treated pigments failed the bimetallic corrosion test within 150 hours.

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F. Flexibility Study of 301-284-D Topcoat

Samples of the better coatings developed during the work on this contract were sent to the Coating and Chemical Laboratory, Aberdeen Proving Grounds, Maryland, for evaluation. A comment was made that the 301-284-D olive drab topcoat was lacking in flexibility.

Several things were tried in an attempt to improve the flexibility of this coating. They included:

- a. Increasing the amount of Multron R-16 used.
- b. Varying the proportions of all ingredients.
- c. Adding a plasticizer other than Multron R-16.
- d. Altering the PVC of this coating.
- e. Using isocyanates other than Mondur CB-75.

It was found that removing the Multron R-16 and part of the Mondur CB-75 and catalyzing with Trancoa 560B provided the best flexibility. A topcoat made from this vehicle, 301-433-J, was almost perfect in galvanic corrosion resistance. A coating very similar to 301-433-J can be made by catalyzing 301-284-D with component C (see section B in the appendix) rather than component B, the normal catalyst used with 301-284-D.

G. Olive Drab Topcoats Containing Miscellaneous Vehicles
Olive Drab Topcoats were prepared from a number of
miscellaneous vehicles. All were considered inferior
to the best topcoats in galvanic corrosion resistance
as can be seen from Table 77. No salt spray tests
were performed.

Table 77

Bimetallic Corrosion Testing of Miscellaneous Olive Drab Topcoats

	bimerallic Cor	Corrosion Testing o	rosion Testing of Miscellaneous Olive Drab Topcoats	
Primer Code	Topcoat Code		Topcoat Vehicle	Rating
301-103-A 301-275-E	301-315-C 301-315-C	Midland X-3928 Midland X-3928		7 7
301-103-A 301-275-E	301-334-C 301-334-C	Midland X-4415 Midland X-4415		88
301-103-A	301-349-C	Midland X-4323:	Mondur CB-75	8 8
301-275-E	301-349-C	Midland X-4323:	Mondur CB-75	
301-103-A	301-349-D	Midland X-4323:	Midland X-3934	7 7
301-2/5-E	301-349-D	Midland X-4323:	Midland X-3934	
301-103-A	301-408-A	Polylite 8703;	Monostyrene	44
301-275-E	301-408-A	Polylite 8703;	Monostyrene	
301-103-A	301-408-B	Polylite 8/02:	Monostyrene	7 7
301-275-E	301-408-B	Polylite 8/02:	Monostyrene	
301-103-A	301-409-A	Polylite 8/03:	Vinyltoluene	44
301-275-E	301-409-A	Polylite 8/03:	Vinyltoluene	

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	200	Less than 500	Less than 500
Rating	0	п	2	m ·	4	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Section XI

Miscellaneous White Topcoat Work

- A. Effect of Various White Pigments on Corrosion Resistance
 Since very few of the initial white topcoats showed good
 corrosion resistance, it was decided to evaluate other
 white pigments for improved corrosion resistance. The
 pigments used were:
 - 1. Antimony oxide
 - 2. Zinc oxide
 - 3. Zinc sulfide
 - 4. Barium sulfate
 - 5. Caloride process titanium dioxide

These pigments are represented by the symbols in Table 78.

The vehicles used in these topcoats were:

- 1. Midland R-55
- 2. Dow Corning R-6-0031: Multron R-16: Mondur CB-75
- 3. Epon 1001: Dow Corning Z-6020

Table 78

Symbols Representing Pigments

- A Sulfate process titanium dioxide
- B Antimony oxide
- C Zinc sulfide
- D Barium sulfate
- E Chloride process titanium dioxide
- F Zinc oxide

The bimetallic corrosion results in Table 79 show the following pigment systems to be better than the sulfate process titanium dioxide pigmentation:

- 1. 65% sulfate type TiO2: 35% zinc oxide
- 2. 50% sulfate process TiO2: 50% zinc sulfide
- 3. 100% chloride process TiO2.

B. White Topcoats Containing Same Vehicles as Best Olive Drab Topcoats

Based on the results obtained when other white pigments were used, some white topcoats were prepared using a combination of chloride process titanium dioxide and either zinc oxide, zinc sulfide, or barium sulfate.

The same vehicles used in the best olive drab topcoats were used for this study. None of these materials was any better in corrosion resistance than the same coatings using the sulfate process titanium dioxide. Galvanic corrosion and salt spray results can be found in Tables 80 and 81.

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Table 79

	Piements
	White
	Various
	Containing
!	t Topcoats
•	ö
	Testing
	Corrosion
	bimetallic Corre

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-103-A	301-210-н		100%	
301-103-A	301-259-C	Midland R-55	85% A	, 6
	,		15% B	ı
301-103-A	301-259-B	Midland R-55	_	2
301-108	301 350 4	7 T T T T T T T T T T T T T T T T T T T		
W-507-705	9-4C7-TOC	MIGLANG K-33		2
301-103-A	301-327-K	Midland R-55		•
			15% F	-
301-103-A	301-327-J	Midland R-55		1
4 601 106	100			
9-501-105	30T-32/-H	Midland R-55		7
103	1 200 100			
301-103-A	301-326-A			7
301-103-A	301-328-E	Midland R-55	50% A	7
	:	•		
301-103-A	301-328-H	Midland R-55		7
			50% D	
301-103-A	301-326-J	Midland R-55		2
301-275-E	301-210-н	Midland R.S.	\$00°E	c
301-275-E	301-259-0	Midle		7 (
1-01-100	2-767-100	בדרדמוות ע-ים		7
301-275-E	301-259-B	Midland R-55	15% B	c
1				7
301-275-E	301-259-A	Midland R-55		•
				•
301-275-E	301-327-K	Midland R-55	85% A	7
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1			
301-275-E	301-327-J	Midland R-55	65% A	2

4

Table 79 (continued)

e Pigments	
White	
Various	
n Testing of Topcoats Containing Various White	
Topcoats	
o£	
Testing	
Corrosion	
imetallic	

	bimerat	DIMETALLIC COLLOSION LESCANS OF TOPCOACS CONCAINING VALLOUS WITLE FABREILS		
Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-275-E	301-327-н	Midland R-55	50% A	7
301-275-E	301-326-A	Midland R=55		7
301-275-E	301-328-E	Midland R-55	-	0
301-275-E	301-328-н	Midland R-55	50% C 50% A	2
			20% D	
301-275-E	301-326-J	Midland R-55		-1
301-103-A	301-182-B	Multron R-16: Mondur	100% A	ო
301-103-A	301-328-A		•	7
4.501.100	W_705_105	Das Corning B_6=0031: Miltron B=16: Mondur CB=75	13% F 65% A	2
W_COT_TOC	11-110-100		35% F	
301-103-A	301-327-L	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A	7
				•
301-103-A	301-326-E	Multron R-16: Mondur	-	~
301-103-A	301-328-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	507 C	7
301-103-A	301-328-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% A	7
			50% D	
301-103-A	301-327-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75		7
301-275-E	301-182-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	100% A	e
301-275-E	301-328-A	Multron R-16: Mondur	85% A	Ħ
301-275-E	301-327-м	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	65% A 35% F	1

Table 79 (continued)

Bimetallic Corrosion Testing of Topcoats Containing Various White Pigments

301-275-E 301-275-E 301-275-E 301-275-E 301-275-E 301-103-A 301-103-A 301-103-A	301-327-L 301-326-E		80	
	101-326-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75		7
	01-328-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75		m
	301-328-J	Multron R-16: Mondur	50% C 50% C	o -
	301-327-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75		
	301-183-B 301-328-D	Epon 1001: Dow Corning Z-6020 Epon 1001: Dow Corning Z-6020	100% A 85% A	e 6
	301-328-C		15% F 65% A	8
301-103-A	301-328-в	Epon 1001: Dow Corning Z-6020		7
301-103-A 301-103-A	301-327-B 301-328-G	Epon 1001: Dow Corning Z-6020 Epon 1001: Dow Corning Z-6020	50% F 100% F 50% A	m %
301-103-A	301-329-A	Epon 1001: Dow Corning Z-6020	50% C 50% A	7
301-103-A	301-327-F	Epon 1001: Dow Corning Z-6020	50% D 100% E	7
301-275-E 301-275-E 301-275-E	301-183-B 301-328-D	Epon 1001: Dow Corning Z-6020 Epon 1001: Dow Corning Z-6020	100% A 85% A	1 2
301-275-E 30	301-328-C	Epon 1001: Dow Corning Z-6020	15% F 65% A 35% F	7

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Table 79 (continued)

Bimetallic Corrosion Testing of Topcoats Containing Various White Pigments
Various
Containing
Topcoats
빙
Testing
Corrosion
Bimetallic

		Dimerentary of the			
Primer Code	Topcoat Code		Topcoat Vehicle	Pigment	Rating
301-275-E	301-328-B	Epon 1001:	Dow Corning 2-6020	50% A 50% F	m
301-275-E 301-275-E	301-327-B 301-328-G	Epon 1001: Epon 1001:	Dow Corning Z-6020 Dow Corning Z-6020	100% F 50% A 50% C	r 8
301-275-E	301-329-A	Epon 1001:	Dow Corning 2-6020	50% A 50% D	7
301-275-E	301-327-F	Epon 1001:	Dow Corning Z-6020	100% E	7

Symbols Representing Pigments

A - Sulfate process titanium dioxide

B - Antimony oxide

C - Zinc sulfide

D - Barium sulfate

E - Chloride process titanium dioxide

F - Zinc oxide

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	200	Less than 500	Less than 500
Rating	0	1	7	ĸ	4	ιΛ

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 80

Bimetallic Corrosion Testing of White Topcoats Containing Same Vehicles as Best Olive Drab Topcoats

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-275-E	301-376-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	85% 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	က
301-275-E	301-377-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% E	m
301-275-E	301-377-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	50% E 50% E 50% D	7
301-275-E	301-376-G	Midland R-55	65% E	7
301-275-E	301-377-A	Midland R-55		m
301-275-E	301-377-D	Midland R-55	50% E 50% E 50% D	7
301-275-E	301-376-н	Epon 1001: Dow Corning 2-6020	65% E	٣
301-275-E	301-377-C	Epon 1001: Dow Corning Z-6020	50% E	7
301-275-E	301-377-F	Epon 1001: Dow Corning 2-6020	50% C	7

Symbols Representing Pigments

A - Sulfate process titanium dioxide
B - Antimony oxide
C - Zinc sulfide
D - Barium sulfate
E - Chloride process titanium dioxide
F - Zinc oxide

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	500	200	Less than 500	Less than 500
Rating	0	1	7	ന	4	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 81

5% Salt Spray Testing of White Topcoats Containing Same Vehicles as Best Olive Drab Topcoats

Primer Code	Topcoat Code	Adheston	Results	Hours Tested
301-275-E 301-275-E 301-275-E	301-376-F 301-377-B 301-377-E	000	Some very small blisters; slight corrosion on scribe. Many very small blisters; slight corrosion on scribe. Many very small blisters; slight corrosion on scribe.	2000 2000 2000
301-275-E	301-376-G	0	Some very small blisters; few small blisters and slight	2000
301-275-E 301-275-E	301-377-A 301-377-D	00	corrosion on scribe. Many very small blisters; slight corrosion on scribe. Some very small blisters; slight corrosion on scribe.	2000
301-275-E	301-376-н	0	Few very small blisters; one small blister and slight	2000
301-275-E	301-377-C	0	corrosion on scribe. Many very small blisters; few small blisters and slight	2000
301-275-E	301-377-F	0	corrosion on scribe. Many very small blisters; slight corrosion on scribe.	2000

1

Adhesion Rating System

Rating	Description	Rating	Description
0	Excellent Adhesion	0	Excellent Adhesion
-	Less than 10% failure, topcoat from primer	1.	Less than 10% failure, primer from substrate
7	10-25% failure, topcoat from primer	2P	10-25% failure, primer from substrate
ო	25-50% failure, topcoat from primer	3P	25-50% failure, primer from substrate
4	50-75% failure, topcoat from primer	4Þ	50-75% failure, primer from substrate
5	Complete lifting of topcoat from primer	5P	Complete lifting of primer from substrate

C. Effect of Various Extender Pigments on Corrosion Resistance
All previous work on white topcoats had been done using
only talc as the extender pigment. In addition, the
pigment content had been kept constant at 53% by weight.

It was then decided to evaluate a number of inert pigments
at a wide range of pigment contents. The following
extender pigments were chosen for evaluation:

- (1) calcium carbonate
- (2) micronized talc
- (3) Cab-0-Sil
- (4) Santocel 54
- (5) Syloid 162

Pigment content was varied from 20 to 70% by weight.

The bimetallic corrosion results in Table 82 indicate the following combination of inert pigments and pigment contents to be better than the initial combination:

- (1) Talc at 70 or 53% pigment
- (2) Santocel 54 or Syloid 162 at 20% pigment

Only a representative number of these coatings were tested for salt spray resistance. The coatings were all very similar in salt spray performance as can be seen in Table 83.

Table 82

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Primer Code	Toncoat Code	Toncoat Code		4	,
		מאראם במחודום	extender rigment	riguent	Kating
301-275-E	301-364-A	Midland R-55	CaCO	62	~
301-275-E	301-364-G	Midland R-55	င်မှုင်ပ	2 9) c
301-275-E	301-360-н	Midland R-55	(C) a)	2.0	٦,
301-275-E	301-365-1	Midland R-55	4 to 5	3 6	۱ ۲
301-275-E	301-368-8	Midland R-55	Talc	2 6	٦ د
301-275-E	301-368-C	Midland R-55	7 Tal.	, c	7 m
301-275-E	301-360-G	Midland R-55	Santocel 54		, ~
301-275-E	301-363-D	Midland R-55		35	۰,
301-275-E	301-360-F	Midland R-55	Syloid 162	23 6	- ۱
301-275-E	301-363-C	Midland R-55	Syloid 162	35	• ~
301-275-E	301-360-E	Midland R-55	CAR-0-SII.	23	
301-275-E	301-363-B	Midland R-55	CAB-O-SIL	35	. 2
301-275-E	301-364-C	Dow Corning XR-6-0000: Dow Corning Z-6020	Caco	70	c
301-275-E	301-364-J	Corning XR-6-0000: Dow Corning	CaCO	2 09	1 4
301-275-E	301-361-E	Corning XR-6-0000: Dow Corning	Cacos	53	• ••
301-275-E	301-365-K	CR-6-0000; Dow Corning	Talc	202) M
301-275-E	301-368-A	CR-6-0000: Dow Corning	Talc	53	7
301-275-E	301-368-D	CR-6-0000: Dow	Talc	35	(1)
301-275-E	301-361-B	CR-6-0000: Dow Corning	Santocel 54	53	. 7
301-275-E	301-363-G	Corning XR-6-0000: Dow	Santocel 54	35	7
301-275-E	301-361-D	Corning XR-6-0000: Dow	Syloid 162	53	7
301-275-E	301-363-J	CR-6-0000: Dow	Syloid 162	35	7
301-275-E	301-361-C	Corning XR-6-0000: Dow Corning	CAB-0-SIL	53	7
301-275-E	301-363-н	CR-6-0000: Dow	CAB-0-SIL	35	4
		0			;

Table 82 (continued)

	Bimetallic Cor	Bimetallic Corrosion Testing of White Topcoats Containing Various Extender Pigments	r Pigments		
Primer Code	Topcoat Code	Topcoat Vehicle	Extender Pigment	Pigment	Rating
301-275-E	301-364-B	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	CaCO3	70	2
301-275-E	301-364-н	Multron R-16: Mondur	CaCO3	09	-1
301-275-E	301-368-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Talc	70	-
301-275-E	301-368-F	6-0031: Multron R-16: Mondur	Talc	53	
301-275-E	301-369-C	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Talc	35	-
301-275-E	301-361-G	fultron R-16: Mondur	Santocel 54	53	7
301-275-E	301-362-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Santocel 54	45	7
301-275-E	301-369-A	Aultron R-16: Mondur	Santocel 54	35	7
301-275-E	301-365-E	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Santocel 54	20	-
301-275-E	301-362-A	Aultron R-16: Mondur	Syloid 162	53	7
301-275-E	301-362-F	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Syloid 162	45	7
301-275-E	301-369-B	Aultron R-16: Mondur	Syloid 162	35	
301-275-E	301-365-D	Aultron R-16: Mondur	Syloid 162	20	~
301-275-E	301-362-B	Aultron R-16:	CAB-0-SIL	53	7
301-275-E	301-362-G	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	CAB-0-SIL	45	7
301-275-E	301-368-3	fultron R-16: Mondur	CAB-0-SIL	35	7
301-275-E	301-365-C	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	CAB-O-SIL	20	2

1

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	500	500	500	500	Less tnan 500	Less than 500
Rating	0	1	7	m	4	ب

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 83

5% Salt Spray Testing of White Topcoats Containing Various Extender Pigments

rrmer code	Topcoat Code	Adhesion	Results
301-275-E	301-364-B	0	Many very small blisters: slight corrosion on scribe
301-275-E	301-364-н	2	Some very small and few small blisters: slight corrosion on scribe
01-275-E	301-368-E	0	Many very small blisters: slight corresion on scribe
01-275-E	301-368-F	0	Many very small blisters: slight corrosion on scribe
301-275-E	301-369-C	0	Many very small blisters: slight corrosion on scribe
)1-275-E	301-361-G	•	Not Tested.
01-275-E	301-362-E	1	Not Tested.
01-275-E	301-369-A	0	Some very small blisters: slight corrosion on scribe
01-275-E	301-365-E	0	Many very small blisters: slight corrosion on scribe
01-275-E	301-362-A	•	Not Tested.
31-275-E	301-362-F		Not Tested.
)1-275-E	301-369-B	0	Few very small blisters: slight corrosion on scribe.
11-275-E	301-365-D	0	Many very small blisters: slight corrosion on scribe
11-275-E	301-362-B	•	Not Tested.
301-275-E	301-362-G	•	Not Tested.
301-275-E	301-368-3		Not Tested.
301-275-E	301-365-C		Not Tested.
301-275-E	301-360-G	0	Some very small blisters: slight corrosion on scribe.
)1-275-E	301-360-F	0	One small and few very small blisters: slight corrosion on scribe
301-275-E	301-360-E	0	Some very small blisters; slight corrosion on scribe.
301-275-E	301-361-R	c	Manage section of the second o

Adhesion Rating System

Description	Excellent Adhesion	Less than 10% failure, primer from substrate	10-25% failure, primer from substrate	25-50% failure, primer from substrate	50-75% failure, primer from substrate	5P Complete lifting of primer from substrate
Rating	0	11	2P	3P	4P	5P
Description	Excellent Adhesion	Less than 10% failure, topcoat from primer	10-25% failure, topcoat from primer	25-50% failure, topcoat from primer	50-75% failure, topcoat from primer	Complete lifting of topcoat from primer
Rating	•	Ħ	8	ю	4	'n

D. Addition of Chromate and Aluminum Pigments to White Topcoats

Since the chromate pigments seemed to inhibit corrosion when used in primers, it was decided to add small quantities of chromates to some of the white topcoats. A series was also prepared with an addition of 1% aluminum pigment, based on total pigment. In the case of the chromates, 3% of the chromate pigments were used. All of these coatings were somewhat yellow in color.

The results of bimetallic corrosion testing contained in Table 84 show none of these coatings to be substantially better than the corresponding coatings without the chromate or aluminum pigments.

Table 84

Bimetallic Corrosion Testing of White Topcoats Containing Chromate and Aluminum Pigments

	Bimetallic Cor	Bimerallic Corrosion Testing of White Topcoats Containing Cilindre and Atmitting Ligherta	, l	
Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Rating
301-103-A 301-103-A 301-103-A	301-325-A 301-325-B 301-325-C	Midland R-55 Midland R-55 Midland R-55	Zinc Chromate Calcium Chromate Strontium Chromate	777
301-275-E 301-275-E 301-275-E	301-325-A 301-325-B 301-325-C	Midland R-55 Midland R-55 Midland R-55	Zinc Chromate Calcium Chromate Strontium Chromate	777
301-103-A 301-103-A 301-103-A	301-325-D 301-325-E 301-325-F	Epon 1001: Dow Corning Z-6020 Epon 1001: Dow Corning Z-6020 Epon 1001: Dow Corning Z-6020	Zinc Chromate Calcium Chromate Strontium Chromate	226
301-275-E 301-275-E 301-275-E	301-325-D 301-325-E 301-325-F	Epon 1001: Dow Corning 2-6020 Epon 1001: Dow Corning 2-6020 Epon 1001: Dow Corning 2-6020	Zinc Chromate Calcium Chromate Strontium Chromate	777
301-103-A 301-103-A 301-103-A	301-325-G 301-325-H 301-325-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Zinc Chromate Calcium Chromate Strontium Chromate	000
301-275-E 301-275-E 301-275-E	301-325-G 301-325-H 301-325-J	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Dow Corning R-6-0031: Multron R-16: Mondur CB-75	Zinc Chromate Calcium Chromate Strontium Chromate	222
301-275-E 301-275-E 301-275-E 301-275-E	301-378-A 301-378-B 301-378-C 301-378-D	Dow Corning R-6-0031: Multron R-16: Mondur CB-75 Epon 1001: Dow Corning Z-6020 Midland R-55 Dow Corning XR-6-0000: Dow Corning Z-6020	Aluminum Aluminum Aluminum Aluminum	m a m m

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	500	500	Less than 500	Less than 500
Rating	0	1	8	e	4	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

E. White Topcoats Containing Same PVC as Olive Drab Topcoats

Since all the original white topcoats had pigment volume concentrations considerably lower than the olive drab topcoats, it was decided to prepare some white topcoats which had PVC's equal to the olive drab topcoats.

The olive drab coatings, as can be seen from Table 85 were better in galvanic corrosion resistance than the corresponding white materials. The white topcoat made from the R-6-0031: BRS-2600 was a dark buff in color and developed cracks while drying.

Table 85

Bimetallic Corrosion Testing of White Topcoats with Same PVC as Olive Drab Topcoats

Primer Code	Topcoat Code	TO	Topcoat Vehicle	Color	Rating
301-275-E	301-264-B	Dow Corning R-6-0031: Bakelite BRS-2600	Bakelite BRS-2600	Olive Drab	1
301-275-E	301-429-A	Dow Corning R-6-0031: Bakelite BRS-2600	Bakelite BRS-2600	White	N. T.
301-275-E	301-284-D	Dow Corning R-6-0031; Bakelite BRS-2600	Bakelite BRS-2600	Olive Drab	50
301-275-E	301-429-B	Dow Corning R-6-0031; Bakelite BRS-2600	Bakelite BRS-2600	White	
301-275-E 301-275-E	301-270-C 301-429-C	Midland R-55 Midland R-55		Olive Drab White	1

«

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	200	200	Less than 500	Less than 500
Rating	0	-1	7	m	4	5

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N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

F. Previously Eliminated White Topcoats

Since the study of various white and extender pigments indicated the initial pigmentation used in the white topcoats might not be optimum, some of the white topcoats which originally were borderline in performance were re-evaluated with the new pigmentation. The vehicles in these topcoats were:

- (1) Dow Corning R-6-0031: ½" RS Nitrocellulose
- (2) Dow Corning DC-805: 2" Cellulose Acetate Butyrate
- (3) General Electric SR-82: Formvar 7/70

While the galvanic corrosion resistance of some of these white coatings was marginally better than that of the original coatings, not enough improvement was shown to warrant further testing. Galvanic corrosion results can be found in Table 86.

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Table 86

	Bimetalli	c Corrosion Testing of P	Bimetallic Corrosion Testing of Previously Eliminated White Topcoats				
Primer Code	Topcoat Code	Topc	Topcoat Vehicle	Pigment	Extender Pigment	Pigment Content	Rating
301-103-A 301-103-A	301-163-B 301-386-D	Dow Corning R-6-0031: Dow Corning R-6-0031:	y" RS Nitrocellulose y" RS Nitrocellulose	100% A 100% E	Talc Syloid	53% 35%	62
301-103-A	301-387-D	Dow Corning R-6-0031:	y" RS Nitrocellulose		162 Syloid	35%	2
301-103-A	301-388-D	Dow Corning R-6-0031:	ኔ" RS Nitrocellulose	35% F 50% E 50% C	162 Syloid 162	35%	m
301-275-E 301-275-E	301-163-B 301-386-A	Dow Corning R-6-0031: Dow Corning R-6-0031:	չ" RS Nitrocellulose ኝ" RS Nitrocellulose	100% A 100% E	Talc Syloid	53% 53%	6 2
301-275-E 301-275-E 301-275-E	301-386-B 301-386-C 301-386-D	Dow Corning R-6-0031: Dow Corning R-6-0031: Dow Corning R-6-0031:	y" RS Nitrocellulosey" RS Nitrocellulosey" RS Nitrocellulose	100% E 100% E 100% E	162 Talc CaCO3 Syloid	53 % 70 % 35 %	888
301-275-E	301-386-E	Dow Corning R-6-0031:	½" RS Nitrocellulose	100% E	162 Syloid	20%	7
301-275-E	301-387-A	Dow Corning R-6-0031:	ł" RS Nitrocellulose		162 Syloid	53%	3
301-275-E	301-387-B	Dow Corning R-6-0031:	ኒ" RS Nitrocellulose	55% E	162 Talc	53%	7
301-275-E	301-387-C	Dow Corning R-6-0031:	ኔ" RS Nitrocellulose	35% E	CaCO3	70%	ю
301-275-E	301-387-D	Dow Corning R-6-0031:	ት" RS Nitrocellulose		Syloid	35%	2
301-275-E	301-387-E	Dow Corning R-6-0031:	ኔ" RS Nitrocellulose		Syloid Syloid	20%	2
301-275-E	301-388-A	Dow Corning R-6-0031:	ኔ" RS Nitrocellulose	50% E	521 Syloid 162	53%	2

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Table 86 (continued)

Primer Code	Topcoat Code	Topcoat Vehicle	Pigment	Extender	Pigment	Rating
301-275-E	301-388-B	Dow Corning R-6-0031: 3" RS Nitrocellulose		Talc	53%	7
301-275-E	301-388-C	Dow Corning R-6-0031: 3" RS Nitrocellulose	504 704 805 80	CaCO ₃	70%	7
301-275-E	301-388-D	Dow Corning R-6-0031: ½" RS Nitrocellulose		Syloid	35%	7
301-275-E	301-388-Е	Dow Corning R-6-0031: ½" RS Nitrocellulose		Syloid 162	202	7
301-103-A 301-103-A	301-163-F 301-389-D	Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB	100% A 100% E	Taic Syloid 162	53% 35%	62
301-103-A	301-392-D	Dow Corning DC-805: 14" CAB		Syloid	35%	7
301-103-A	301-393-D	Dow Corning DC-805: ½" CAB	50% E 50% E	162 Sylo1d 162	35%	8
301-275-E 301-275-E	301-163-F 301-389-A	Dow Corning DC-805: ½" CAB Dow Corning DC-805: ½" CAB	100% A 100% E	Talc Syloid	53 % 53 %	88
301-275-E 301-275-E 301-275-E	301-389-B 301-389-C 301-389-D	Dow Corning DC-805: \(\frac{1}{2}\)" CAB Dow Corning DC-805: \(\frac{1}{2}\)" CAB Dow Corning DC-805: \(\frac{1}{2}\)" CAB	100% E 100% E 100% E	Talc CaCO ₃ Syloid	53% 70% 35%	222
301-275-E	301-389-E	Dow Corning DC-805: 1" CAB	100% E	Syloid 162	202	7
301-275-E	301-392-A	Dow Corning DC-805: ½ CAB	100% E	Syloid 162	53%	7

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Table 86 (continued)

Primer Code	Topocat Code	Topcoat Vehicle		Pigment	Pigment	Figment Content	Rating
301-275-E	301-392-B	Dow Corning DC-805: 1 CAB		65% E	Talc	53%	7
301-275-E	301-392-C	Dow Corning DC-805: 1/2" CAB		35% F 65% E	CaCO ₃	707	2
301-275-E	301-392-D	Dow Corning DC-805: ½" CAB		35% F 65% E	Syloid	35%	8
301-275-E	301-392-E	Dow Corning DC-805: 1 CAB		35% F 65% E	162 Syloid	202	7
301-275-E	301-393-A	Dow Corning DC-805: 3" CAB		35% F 50% E	162 Syloid	53%	m
301-275-E	301-393-B	Dow Corning DC-805: 1/4" CAB		50% C 50% E	162 Talc	53%	m
301-275-E	301-393-C	Dow Corning DC-805: 1/2" CAB		50% C	CaCO ₃	70%	ю
301-275-E	301-393-D	Dow Corning DC-805: ½" CAB			Syloid	35%	2
301-275-E	301-393-E	Dow Corning DC-805: ½" CAB		50% C 50% E 50% C	162 Syloid 162	202	7
301-103-A 301-103-A	301-163-E 301-394-D	General Electric SR-82: For General Electric SR-82: For	Formvar 7/70 1 Formvar 7/70 1	100% A 100% E	Talc Syloid	53 % 35 %	N M
301-103-A	301-395-D	General Electric SR-82; For	Formvar 7/70		162 Syloid	35%	e
301-103-A	301-396-D	General Electric SR-82: Form	Formvar 7/70	35% F 50% E 50% C	162 Syloid 162	35%	٠,

Table 86 (continued)

		Bimetallic Corrosion Testin	Bimetallic Corrosion Testing of Previously Eliminated White Topcoats	Topcoats			
Primer Code	Topcoat Code	Topcoat Vehicle	ehicle	Pigment	Extender Pigment	Pigment Content	Ratino
301-275-E 301-275-E	301-163-E 301-394-A	General Electric SR-82: F General Electric SR-82: F	Formvar 7/70 Formvar 7/70	100% A 100% E	Talc Syloid	53%	2
301-275-E 301-275-E 301-275-E	301-394-B 301-394-C 301-394-D	General Electric SR-82: F General Electric SR-82: F General Electric SR-82: F	Formvar 7/70 Formvar 7/70 Formvar 7/70	100% E 100% E 100% E	162 Talc CaCO3 Syloid	53 7 70 7 35 7	
301-275-E	301-394-E	General Electric SR-82: F	Formvar 7/70	100% E	162 Syloid	20%	. 2
301-275-E	301-395-A	General Electric SR-82: F	Formvar 7/70	65% E	162 Syloid	23%	4
301-275-E	301-395-в	General Electric SR-82: F	Formvar 7/70	35% F 65% E	162 Ta1c	53%	4
301-275-E	301-395-C	General Electric SR-82: F	Formvar 7/70	35% F 65% E	CaCO ₃	707	4
301-275-K	301-395-D	General Electric SR-82: F	Formvar 7/70	35% F 65% E	Syloid	35%	5
301-275-E	301-395-E	General Electric SR-82: F	Formwar 7/70	35% F 65% E	162 Syloid	20%	4
301-275-E	301-396-A	General Electric SR-82: F	Formvar 7/70		162 Syloid	53%	m
301-275-E	301-396-в	General Electric SR-82: F	Formvar 7/70	50% C	162 Talc	53%	٣
301-275-E	301-396-C	General Electric SR-82; F	Formvar 7/70	50% E	CaCO3	70%	ار.
301-275-E	301-396-D	General Electric SR-82: F	Formvar 7/70		Syloid	35%	'n
301-275-E	301-396-E	General Electric SR-82: F	Formvar 7/70	50% E	Syloid 162	202	ო

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Table 86 (continued)

Bimetallic Corrosion Testing of Previously Eliminated White Topcoats

Symbols Representing Pigments

- A Sulfate process titanium dioxide
 - B Antimony oxide
- C Zinc sulfide
- D Barium sulfate
- E Chloride process titanium dioxide
 - F Zinc oxide

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	500	500	200	Less than 500	Less than 500
Rating	0	1	7	en	4	Ŋ

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

G. Silane Treatment of White Pigments

As in the case of the olive drab pigments, sulfate process titanium dioxide was treated with silanes. Once again topcoats made from the treated pigments were inferior in galvanic corrosion resistance to coatings made from untreated pigments. Coatings containing pigments which had been treated by the silane supplier were equally unsatisfactory.

H. White Topcoats Made from Miscellaneous Vehicles

A number of miscellaneous vehicles were used to
prepare white topcoats. None of these coatings
were considered satisfactory. Bimetallic corrosion
results may be found in Table 87.

Table 87

Bimetallic Corrosion Testing of White Topcoats Using Miscellaneous Vehicles

Primer Code	Topcoat Code	Topcoat Vehicle	Rating
301-103-A 301-275-E	301-334-B 301-334-B	Midland X-4415 Midland X-4415	7 7
301-275-E	301-351-A	Midland X-4323: Mondur CB-75	2
301-275-E	301-351-B	Midland X-4323: Midland X-3934	7
301-275-E	301-434-F	Dow Corning XR-6-0000: Dow Corning XZ-2-2023	·

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	900	500	500	Less than 500	Less than 500
Rating	0	1	2	٣	7	5

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Section XII

Miscellaneous Testing

A. Optimum Thickness of Primer and Topcoat

As mentioned earlier, both primers and topcoats were applied at thicknesses of 0.0015". It was decided to try one system with thicknesses of 0.0005", 0.0010", and 0.0015" for both primer and topcoat. The primer chosen was the 301-103-A Midland R-55 system while the topcoat was the olive drab coating made from the same vehicle. It was determined that any thickness of topcoat would be satisfactory if 0.0015" of primer was used. In addition, if the heaviest thickness of topcoat is used, 0.0010" of primer will produce a satisfactory coating. While it is apparent that a thickness less than 0.0015" for both primer and topcoat may not be necessary for optimum protection, it is believed desirable to use as heavy a coating as possible for best results.

B. Exterior Exposure Panels

Some of the preferred olive drab systems were applied to a variety of substrates and exposed at the following test sites:

- 1. South Florida
- 2. South Florida Tidewater
- 3. Waukegan, Illinois

The coating systems exposed were:

	Primer	Topcoat
1.	301-103-A	301-270-C
2.	301-103-A	301-284-D
3.	301-275-E	301-270-C
4.	301-275-E	301-284-D
5.	301-275-E	301-264-B
6.	407 wash primer	301-270-C
7.	407 wash primer	301-284-D
8.	407 wash primer	301-264-B

The following substrates were used for the testing:

- 1. Dow 17 treated HK-31 magnesium alloy.
- 2. 24ST aluminum alloy.
- 3. Cold rolled steel.
- 4. Bonderite 1000 treated cold rolled steel.
- Dow 17 treated HK-31 magnesium alloy coupled with 24ST aluminum alloy.
- 6. Dow 17 treated HK-31 magnesium alloy coupled with cold rolled steel.

These panels are presently being tested. After 12 months exposure, the following developments have occurred:

- 1. The 60° gloss on all panels has decreased from around 25° to 0° .
- 2. All panels have developed a heavy bronzing.

- All coatings have shown medium to pronounced fading.
- 4. Film integrity of all coatings is excellent.

C. Evaluation of Clear Coatings

Since a great deal of time is necessary to prepare pigmented coatings, it was decided to check the possibility of testing a promising vehicle as a clear over primers for resistance to galvanic corrosion. Only those vehicles which performed well in the clear would then be made into pigmented coatings. This idea was tried and it was felt that it would be satisfactory for any future galvanic corrosion testing.

It was also decided to evaluate some of these clear coatings over some of the better white topcoats. To obtain the necessary low gloss, however, some Syloid 162 was used to flat these clears. The flatted clears were susceptible to water penetration and consequent galvanic corrosion failure.

D. Riveted Bimetallic Panels

Since all bimetallic corrosion testing had been done using the galvanic "cells", it was believed desirable to prepare some coupled panels and test them for resistance to 5% salt spray. Panels were prepared coupling Dow 17 treated HK-31 magnesium panels with either cold rolled steel or 24ST aluminum alloy panels.

The panels were fastened with 5056S aluminum alloy rivets. It was impossible, when coupling the panels in this manner, to completely eliminate the air space between the panels where the two metals lapped. It was also impossible to cover this space when applying the primer and topcoat by spray.

Panels joined in this manner were sprayed with some of the preferred coating systems and placed in a 5% salt spray cabinet. All failed within 48 hours due to severe corrosion of the magnesium. In each case the corrosion occurred at the unprotected lapped portion of the panel.

Duplicate panels were prepared. This time, however, some unreduced primer was placed in a syringe and applied to the problem area. The panels were primed, topcoated, and tested as before. There was a dramatic improvement in results. (See figs. 11 and 12) Almost all systems developed no more than a few small blisters within 500 hours. Most coupled panels on exterior exposure testing were protected in this manner.

E. Baked Coatings

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While the provisions of this contract call for an air dry coating, it was agreed that we should bake some of the preferred systems to determine if baking would improve their corrosion resistance. A cure of 15 minutes at 350°F. was chosen. In all cases, only the 301-275-E primer was used.

The 301-284-D and 301-270-C systems were improved only slightly by the bake. The 301-264-A system was unaffected after 500 hours in the galvanic cell, however. The 301-284-D system also was perfect when cured 30 minutes at 400°F.

FIG. 11

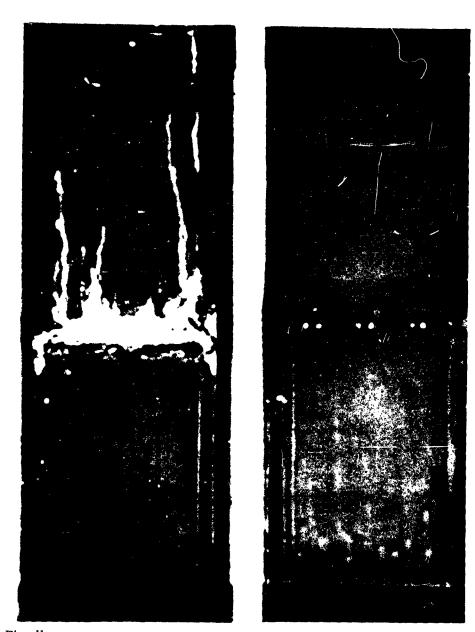


Fig. 11

5% SALT SPRAY RESULTS (ON MAGNESIUM-STEEL COUPLED PANELS)

OF OLIVE DRAB COATING SYSTEM WITHOUT AND WITH PROTECTION
OF LAPPED AREA

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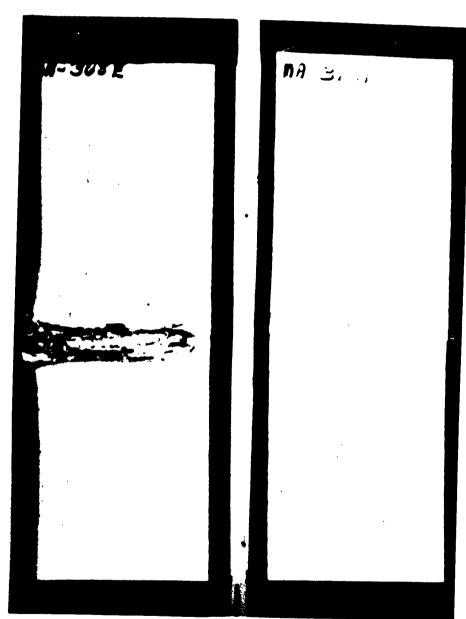


Fig. 12

5% SALT SPRAY RESULTS (ON MAGNESIUM-STEEL COUPLED PANELS)
OF WHITE COATING SYSTEM WITHOUT AND WITH PROTECTION
OF LAPPED AREA.

F. Final Testing of Preferred Systems

All of the promising coating systems developed were, of course, subjected to bimetallic and salt spray corrosion testing. In addition, they were tested for resistance to MIL-S-3136 fluid and diester lubricant. The coatings were also tested for heat stability. The results of these tests can be found in Table 88.

All of these coating systems are regarded as having satisfactory resistance to the test fluids. Those coatings which soften in the fluids soften only slightly and recover full hardness within 24 hours. The coatings which are indicated as being satisfactory for heat resistance are so rated because no flaking of the coating has occurred. Most of them, however, do become quite inflexible but are still not easily removed from the substrate. The 301-360-F material became very dark brown in color and the 301-368-F coating was only slightly less dark. All of the olive drab coatings will withstand 2 hour exposures to temperatures as high as 600°F, without flaking off the panel although their film integrity is definitely adversely affected by the increase in temperature.

Table 88

		Final Testing	Final Testing of Preferred Coating Systems	g Systems		
Primer Code	Topcoat Code	MIL-S-3136 Fluid 4 hr. lamersion 24 hr	Fluid 24 hr. Recovery	Lubri 4 hr. Immersion	Lubricant ion 24 hr. Recovery	Heat Exposure
301-103-A 301-275-E	301-284-D 301-284-D	Ω	1 1	םם		N.G.
301-103-A 301-275-E	301-270-C 301-270-C	တ တ	YES YES	םמ		0 O
301-275-E	301-264-B	W	YES	n	ı	0.K
301-103-A 301-275-E	301-278-C 301-278-C	s D	YES	ממ		0.K.
301-103-A	301-278-E	w	YES	D	ı	0.K.
301-275-E	301-360-F	w	YES	n	•	0.K.
301-275-E	301-368-F	n	ı	Đ	1	0.K.

Key to Symbols

Film Integrity

0.K. - No perceptible change except for darkening.

- Blistered

N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected

S - Softened

D - Dissolved

24 Hour Recovery

Yes - Recovered original properties

No - Did not recover original properties

Section XIII

Additional Research

The preceding sections of the report cover the work done during the contracted time. It was decided that several promising areas required additional work and the contract was extended for the necessary time.

A. Vinyl Coatings

Bakelite's XYHL, VAGH, and QYNV were screened in clear coatings. The XYHL and VAGH were combined with an isocyanate and/or tetrabutyl titanate.

The results of the screening may be found in Table 89.

B. Epoxy Coatings

The complete range of epoxy resins was catalyzed with varying amounts of an isocyanate. Screening test results may be found in Table 90.

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Screening of Vinyl Resin Systems

Comments	:	:	Rittle	Brittle	Brittle	;	:	:	:
Lubricant 24 hr.	ı	Yes		ı	ı	ı	•	1	ı
Lub 4 hr. Immers.	n	S	ם	n	n	n	ນ	n	ב
MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recovery	ı	Y.	•	•	ı	•	1	1	ı
MIL-S-31 4 hr. Immers.	n	S	n	n	n	n	5	D	n
Air Dried Film Dry Adhesion	0	က	0	0	0	1	0	0	0
Air D	0	0	0	0	0	-	0	0	ч
Type of Resin	85% XYHL 15% Mondur CB-75	AKAD	88% VAGH 12% Mondur CB-75	84% VASH 16% Mondur CB-75	80% VAGE 20% Mondur CB-75	99.5% VAGH 0.5% Tetrabutyltitanate	99% VACH 1% Tetrabutyltitanate	98% VAGH 2% Tetrabutyltitanate	96% VAGH 4% Tetrabutyltítanate
Vehicle Code	301-442-C	301-442-D	301-442-EA	301-442-EB	301-442-EC	301-462-A 9	301-462-B	301-462-C	301-462-D

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Cood	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating		~ .	2	e	4	s

Film Integrity

0.K. - No perceptible change except for darkening.
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery	Yes - Recovered original properties No - Did not recover original properties
Gasoline and Lubricant Resistance	U - Unaffected S - Softened D - Dissolved

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Table 90

Screening of Epoxy-Polyurethane Systems

		uruaa	ocreening of choxy-rotyurethane systems	oryurernan	e Systems			
Vehicle Code	Type of Resin	Air D	Air Dried Film Dry Adhesion	MIL-S-31 4 hr. Immers.	MIL-S-3136 Fluid 4 hr. 24 hr. Inmers. Recovery	Lubr 4 hr. Immers.	Lubricant 24 hr.	Comments
301-459-A	70% Dow Corning XR-6-0000 30% Mondur CB-75	-	0	တ	YES	n	ı	•
301-459-B	66% Dow Corning XR-6-0000 34% Mondur CB-75	-	0	S	NO	Ω	•	ı
301-459-C	62% Dow Corning XR-6-0000 38% Mondur CB-75	0	1	Ø	ON	Ð	ı	Brittle
301-459-D	62% Rpon 828 38% Mondur CB-75	7	1	S	ON	w	ON	Soft
301-459-E	57% Spon 828 43% Mondur CB-75	7	1	S	ON	w	Q	Soft
301-459-F	50% Mondur CB-75	o ,	1	S	Ö.	w	ON	Sligntly Brittle
301-459-G	54% Rpon 834 46% Roadur CB-75	m	1	Ø	ON	w	Q _N	Soft
301-459-н	50% Bpon 834 50% Mondur CB-75	-		S	NO N	4	•	Brittle
301-459-J	43% Boon 834 57% Mondur CB-75	H	7	w	ON	w	ON	Brittle
301-459-K	52% Epon 1002 48% Mondur CB-75	1	-	Ð		n	•	Brittle

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Table 90 (continued)

Systems	
lvurethane	
Epoxy-Pol	
Screening of	

all de la company de la compan	Systems		301-460-A 52% Epon 1002 1 1 U U - U - Slightly Brittle	301-460-B 40% Bpon 1002 0 0 U - U - Slightly Brittle 60% Mondur CB-75	301-460-C 57% Epon 1007 1 1 U - U - Brittle	301-460-D 53% Epon 1007 1 1 U - U - Brittle	301-460-E 47% Epon 1007 1 1 U - U - Brittle 53% Nondur CB-75	301-469-A 57% Epon 872 1 0 S YES D	301-469-B 64% Epon 872 1 0 S YES S NO -	301-469-C 70% Epon 872 1 0 S YES S NO -	
--	---------	--	--	---	---	---	--	------------------------------------	---	---	--

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Poog	Fair	Poor	Extremely Poor
Z _H	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	-	7	ന	4	٠,

Film Integraty

0.K. - No perceptible change except for darkening.B - BlisteredN.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties No - Did not recover original properties

C. Silicone-Polyester Coatings Catalyzed with Isocyanates and Amines

Since we had earlier found a silicone-polyester catalyzed with an isocyanate to produce a coating with most of the properties needed, some additional testing was done in this area. Two experimental silicone-polyester copolymers were catalyzed with Mondur CB-75 and screened in the usual manner. In addition, Dow Corning Z-6020 aminosilane and triethylamine (TEA) were also evaluated as catalysts. The test results may be found in Table 91.

D. Miscellaneous Materials

A number of other polymers were also screened. Some of these were chosen because similar types of materials had previously performed well. Others were included because their chemical type had not been studied before and their omission would prevent this contract from being as complete as it could be.

Table 91

Screening of Silicone-Polyesters Catalyzed with Isocyanates and Amines

Comments	•	i	ı	Slightly Brittle	Brittle	Brittle	Brittle	,	ı	Slightly Brittle
Lubricant 24 hr.	•	•	1	•	ON	YES	ı	9	ON	NO
Lubr 4 hr. Immers.	n	n	Ω	Ω	Ø	w	b	S	S	တ
MIL-S-3136 Fluid 4 hr. 24 hr. Inners. Recovery	•	•	ı	ı	NO NO	&	<u>8</u>	ON	NO NO	NO NO
MIL-S-31 4 hr. Immers.	Ð	D	n	n	S	w	Ø	w	w	ω
Air Dried Film Dry Adhesion	1	0	0	0	0	0	0	-		1
Air Di	0 52-1	CB-75 0	0 51-1	0 52-1	-	1	-	7	-	7
de Type of Resin	301-458-A 84% X-4633; 10% Mondur CB-75	74% X-4633; 26% Mondur CB	301-458-C 63% X-4633; 37% Mondur CB-75	50% X-4633; 50% Mondur CB-75	98% x-4633; 2% Dow Corning z-6020	95% X-4633; 5% Dow Corning Z-6020	90% X-4633; 10% Dow Cerning Z-6020	98% Dow Corning R-6-0031; 2% Dow Corning Z-6020	95% Dow Corning R-6-0031; 5% Dow Corning Z-6020	90% Dow Corning R-6-0031; 10% Dow Corning Z-6020
Vehicle Code	301-458-A	301-458-B	301-458-C	301-458-D	301-458-E	301-458-F	301-458-G	301-458-н	301-458-J	301-458-K

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Table 91 (continued)

Screening of Silicone-Polyesters Catalyzed with Isocyanates and Amines

Vehicle Code	Type of Resin	Air E	ried Film	MIL-S-31	MIL-S-3136 Fluid	Lubr	Lubricant	
		DEX	Dry Adhesion	4 hr. Immers.	4 hr. 24 hr. Immers. Recovery	4 hr. Immers.	24 hr.	Comments
301-460-F	99% Dow Corning R-6-0031; 1% TEA	8		S	ON	S	ON	Soft
301-460-6	96% Dow Corning R-6-0031; 2% TEA	8	-	w	ON.	w	NO	Soft
301-460-н	95% Dow Corning R-6-0031; 5% TEA	7	-	S	ON	vs	NO	Brittle
301-460-3	99% X-4633; 1% Tea	1	7	Ø	ON	S	ON	Brittle
301-460-K	98% X-4633; 2% TBA	1	-	Ø	NO	ß	ON	Brittle
301-460-L	95% X-4633; 5% T RA	7	1	Ø	NO	ß	ON	Brittle
301-473-A	83% X-4636;	0	0	n	ı	n	ı	Brittle
301-473-B	72% X-4636; 27% Mondux CB-75	0	0	D	•	Þ	1	Brittle
301-473-C	63% X-4636; 37% Mondur CB-75	0	0	n		'n	•	Brittle
301-473-D	50% X-4636; 50% Mondur CB-75	0	0	ם	1	n	ı	Brittle

Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Good	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	က	4	5

Film Integrity

O.K. - No perceptible change except for darkening
B - Blistered
N.G. - Extensive flaking or other loss of film integrity.

24 Hour Recovery	
Gasoline and Lubricant Resistance	

U - Unaffected
S - Softened
D - Dissolved

Yes - Recovered original properties No - Did not recover original properties

Included in the latter group are some materials not normally associated with coatings. In many cases it was necessary to use unusual solvents or to apply the coatings from dispersion to obtain continuous films. Some materials also required the use of heat but for preliminary screening purposes were not eliminated for this reason. Attempts were made to obtain inorganic polymers but these materials were unavailable. The screening results may be found in Table 92.

E. Bimetallic Corrosion and Salt Spray Testing of Primers and Clear Coatings

A number of the clear coatings in sections XIII A-D (above) were believed worthy of additional testing.

These materials were evaluated in the normal manner for resistance to galvanic corrosion. The clears were tested over unprimed Dow 17 treated HK-31 magnesium alloy and/or over the same substrate primed with 301-275-E calcium chromate primer. In addition some of these resin systems were incorporated into calcium chromate primers. Some isocyanate catalyzed silicone copolymers were also tested in the galvanic cells. The silicone copolymers include Midland X-4641, X-4646, X-4664, X-4669, X-4661, X-4676, Dow Corning XR-6-0066, XR-6-0059, and XR-6-0041. Galvanic corrosion test results may be found in Table 93.

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Table 92

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- 340 -Table 92 (continued) Screening of Miscellaneous Materials

	51	מרו בכוודוום						
Vehicle Code	Type of Resin	Air D	Air Dried Film Dry Adhesion	MIL-S-3136 Fluid 4 hr. 24 hr. Immers. Recover	36 Fluid 24 hr. Recovery	Lubr 4 hr. Immers.	Lubricant r. 24 hr. ers. Recovery	Comments
301-445-C	25% Epon 1001; 37% Epon 828; 6% Dem-10; 32% Thiokol LP-3	0	0	Ø	YES	ß	YES	Eyeholes
301-446-C	Thickol LP-3 Polysulfide	S	2	1	•	1	ı	•
301-446-D	Thickel LP-3 Polysulfide	5	2	1	•	1		•
301-646-B	Thiokol FA Polysulfide Rubber	*	2	Ω		n	ı	Soft
301-452-A	DuFont Adiprene L-167 Polyurethane Rubber	7	7	n		w	NO	•
301-452-B	91% Adiprene L-167; 9% Versamid 115	ю	1	s	NO N	s	NO NO	•
301-452-C	97% Adiprene L-167; 3% Tetrabutyltitanate	ဗ	1	۵		w	ON ON	1
301-452-D	99.9% Adiprene L-167; 0.1% Tetrabutyltitanate	7	1	n	ı	b	ı	Slow Cure
301-461-c	87% Thiokol LP-3; 13% Triethylenstetramine	1	1	Ω	•	n	•	•
301-461-A	92% Epon 1002; 4% Tetrabutyltitanate; 4% Diethylene Triamine	т	0	Þ	ı	n	ı	•
4-4-4-4-A	Impont Delrin	*	-	n	•	Þ	•	Brittle
301-447-A	Goodyear Vitel 200	-	-1	D	•	n	•	•

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Table 92 (continued)

							(
Vehicle Code				Scr	Screening of Miscellaneous Materials	cellaneous	Materials			
	Type of Kesin			Air Dry	Air Dried Film Dry Adhesion	MIL-S-31	MIL-S-3136 Fluid 4 hr. 24 hr.	Lub 4 hr	Lubricant	
301-447-F	301-447-F Goodyear Vitel 207			^	r	Immers.	mmers. Recovery	Inmers.	Immers. Recovery	Co
301-447-G	301-447-G 50% Goodyear Vitel	200	FOR WALL	1 6	N	S	NO	S	W	•
301-447-C	301-447-C 388 Uttel 2001-		20 ATCET 201 7	7 / 07	~	S	YES	S	YES	•
301-447-D	XZ9 (DOZ TATE ZOO) 9ZX	A VARIET		-	-	S	YES	n	•	l
301 177	201 //7 = 16% Vitel 200; 82%	VYHH			2	S	YES	Ħ	1	•
307-44/-E	301-44/-E 67% Vitel 200; 33%	VYHH		-	1	U	•) =	•	•
301-447-H	301-447-H 73% Vitel 200; 27%	Exon 461	461	1	1	S	ON	· -	1 1	1

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Key to Numerical Ratings and Symbols

Adhesion	Excellent	Very good	Cood	Fair	Poor	Extremely Poor
Dry	Hard	Tack-free but slightly soft	Tack-free but Soft	Slightly tacky	Tacky	Very tacky
Rating	0	1	2	က	4	5

Film Integrity

0.K. - No perceptible change except for darkening.

B - Blistered

N.G. - Extensive flaking or other loss of film integrity.

Gasoline and Lubricant Resistance

U - Unaffected
S - Softened
D - Dissolved

24 Hour Recovery

Yes - Recovered original properties No - Did not recover original properties

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Table 93

	•	Bimetallic Con	Bimetallic Corrosion Testing of Primers and Clear Coatings	
Coating Code	901-275-E	Pigmentation	Coating Vehicle	Rating
301-442-A	Yes	Clear *	Pennsalt Kynar Vinylidene Fluoride Dispersion	-
301-442-C	Yes	Clear	Bakelite XYHL; Mondur CB-75	4
301-442-D	Yes	Clear *	Bakelite QYNV Organosol	0
301-442-EA	Yes	Clear	Bakelite VAGH; Mondur CB-75	m
301-445-C	Yes	Clear	Epon 828; Epon 1001; Thiokol LP-3	4
301-446-B	Yes	Clear *	Thiokol FA Polysulfide Rubber	7
301-453-A	N _S	Clear	Firestone Exon 461 Fluorinated Copolymer	7
301-453-A	Yes	Clear	Firestone Exon 461 Fluorinated Copolymer	7
301-453-B	S.	Clear	3M Kel-F 800 Fluorinated Copolymer	7
301-453-B	Yes	Clear	3M Kel-F 800 Fluorinated Copolymer	7
301-467-C	og.	Calcium Chromate	Firestone Exon 461	'n
301-467-E	No.	Calcium Chromate	3M Kel-F 800	\$
301-447-A	Yes	Clear	Goodyear Vitel 200 Polyester	~
301-467-A	No	Zinc Chromate	Goodyear Vitel 200 Polyester	4
301-467-B	ž	Calcium Chromate	Goodyear Vitel 200 Polyester	4
301-447-E	Yes	Clear	Goodyear Vitel 200; Bakelite VYHH	-

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Table 93 (continued)

	10 de 10 de	Bimetallic	Bimetallic Corrosion Testing of Primers and Clear Coatings	
Coating Code	301-275-E	Pignentation	Coating Vehicle	Rating
301-452-A	Yes	Clear	DuPont Adiprene L-167 Polyurethane Rubber	7
301-470-A	æ	Calcium Chromate	DuPont Adiprene L-167 Polyurethane Rubber	Ŋ
301-454-A	№	Clear *	DuPont Delrin Acetal	5
301-461-A	Yes	Clear	Epon 1002; Tetrabutyltitanate; Diethylenetriamine	7
301-471-A	&	Calcium Chromate	Epon 1002; Tetrabutyltitanate; Diethylenetriamine	•
301-499-6	Q.	Clear	Hercules Penton Chlorinated Polyether	4
301-475-A	Š	Calcium Chromate	Epon 834; Thiokol LP-3; Trietinylenetetramine	'n
301-490-B	Se.	Calcium Chromate	Bakelite PKDA 8500 Phenoxy Resin	v
301-490-D	SS.	Calcium Chromate	Bakelite PKDA 8500; Mondur CB-75	'n
301-498-B	No.	Calcium Chromate	Pennsalt Kynar Solution	4
301-500-A	Ş	Red Lead	Dow Corning XR-6-0000; Versamid 115	7
301-500-C	S.	Red Lead	Tung Oil Phenolic Varnish	2
301-500-D	Ŋ.	Red Lead	Midland R-55 Epoxy Ester	8
302-404-A	No O	Calcium Chromate	Dow Corning XR-6-0000; Versamid 115: General Electric SC-50 Sodium Methyl Siliconate	7
301-459-A	No	Clear	Dow Corning XR-6-0000; Mondur CB-75	7

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Table 93 (continued)

	7	Bimetallic Co	Bimetallic Corrosion Testing of Primers and Clear Coatings
Coating Code	301-275-E	Pigmentation	Coating Vehicle
301-458-C	£	Clear	Midland X-4633; Mondur CB-75
301-470-C	£	Calcium Chromate	Midland X-4633; Mondur CB-75
301-479-A	æ	Clear	Midland X-4641; Mondur CB-75
301-483-A	&	Calcium Chromate	Midland X-4641; Mondur CB-75
301-479-B	SK.	Clear	Midland X-4646; Mondur CB-75
301-479-C	S.	Clear	Midland X-4678; Mondur CB-75
301-479-D	æ	Clear	Midland X-4664; Mondur CB-75
301-483-C	æ	Calcium Chromate	Midland X-4664; Mondur CB-75
301-479-E	윷	Clear	Midland X-4649; Mondur CB-75
301-479-G	£	Clear	Midland X-4661; Mondur CB-75
301-479-н	Ą	Clear	Midland X-4676; Mondur CB-75
301-478-B	æ	Calcium Chromate	Midland X-4636; Mondur CB-75
301-482-K	윷	Calcium Chromate	Midland X-4717; Mondur CB-75
301-483-B	Š	Calcium Chromate	Midland X-4648; Mondur CB-75
301-483-E	SZ.	Calcium Chromate	Midland X-4714; Mondur CB-75

Table 93 (continued)

	,	Bimetallic C	Bimetallic Corrosion Testing of Primers and Clear Coatings	
Coating Code	Primed with 301-275-E	Pigmentation	Coating Vehicle	Rating
301-483-F	2	Calcium Chromate	Midland X-4716; Mondur CB-75	s
301-494-A	£	Calcium Chromate	Midland X-4728; Mondur CB-75	7
301-494-B	2	Calcium Chromate	Midland X-4770; Mondur CB-75	2
301-479-3	%	Clear	Dow Corning XR-6-0066; 2.5% Mondur CB-75	4
301-479-K	&	Clear	Dow Corning XR-6-0066; 5% Mondur CB-75	4
301-479-L	2	Clear	Dow Corning XR-6-0066; 7.5% Mondur CB-75	4
301-482-A	&	Clear	Dow Corning XR-6-0059; 2.5% Mondur CB-75	4
301-482-B	<u>Q</u>	Clear	Dow Corning XR-6-0059; 5% Mondur CB-75	S
301-482-C	æ	Clear	Dow Corning XR-6-0059; 7.5% Wondur CB-75	Ŋ
301-482-6	2	Clear	Dow Corning XR-6-0059; 12% Mondur CB-75	ፉ
301-482-D	2	Clear	Dow Corning XR-6-0041; 2.5% Mondur CB-75	S
301-482-E	2	Clear	Dow Corning XR-6-0041; 5% Mondur CB-75	•
301-482-F	£	Clear	Dow Corning XR-6-0041; 7.5% Mondur CB-75	٠
301-482-н	2	Clear	Dow Corning XR-6-0031; Mondur CB-75	7

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Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	200	Less than 500	Less than 500
Rating	. 0	1	7	e	4	٧.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Some of these coatings were also applied to Dow 17 treated HK-31 magnesium alloy and tested for resistance to 5% salt spray. Salt spray exposure results may be found in Table 94.

A number of other primer type coatings were evaluated.

These included the following:

- International Rustproof Irco I.O.X. 1011 and Irco 9301. These materials were used as additives in the silicone-epoxy: polyamide primer.
- Hercules Powder Co. Rosin Amine D. This material was added to the same primer.
- Americat Corporation Dimetcote #4 zinc silicate coating.
- 4. Napko Corporation Zacrote #1360 zinc silicate coating.
- 5. Union Carbide Ucar R-101 and R-104 silicone metal treatments. These materials were used as an undercoat for the silicone-epoxy: polyamide primer.

 The Dow Corning R-6-0031: Mondur CB-75 white topcoat was used.

Bimetallic corrosion testing results may be found in Table 95.

Table 94

	1000	5% Salt Spray Testing of Primers and Clear Coatings	
Coating Code	301-275-E	Results	Hours Tested
301-442-A 301-442-C 301-442-D 301-442-EA	₹ ₹ ₹ ₹ ₹ ₹	Few very small blisters; slight corrosion and few small blisters on scribe. Many small and very small blisters. Slight corrosion on scribe. Some very small blisters; few small blisters on scribe.	2000 2000 2000 2000
301-445-C	Yes	Slight corrosion and few small blisters on scribe.	2000
301-447-A 301-447-E	Yes	Few very small blisters; slight corrosion on scribe. Few small and very small blisters; slight corrosion and few small blisters on scribe.	2000
301-453-A 301-453-A	No Yes	Few very small blisters; slight corrosion and few small blisters on scribe. Many very small blisters; slight corrosion on scribe.	2000
301-453-B 301-453-B	No Yes	Few very small blisters; slight corrosion and few small blisters on scribe.	2000
301-452-A	Yes	Few very small blisters; slight corrosion and few small blisters on scribe.	2000
301-454-A	Yes	Slight corrosion, some small and very small blisters; slight corrosion on scribe.	2000
301-461-A	Yes	Few very small blisters.	2000
301-467-A 301-467-B 301-467-C 301-467-E	2222	Many small and very small blisters, slight corrosion. Many small and very small blisters. Severe corrosion. Severe corrosion.	2000 2000 2000 2000

Table 95

Bimetallic Corrosion Testing of Miscellaneous Primers

Coating Code	Coating Type	90
301-488-A	Dow Corning XR-6-0000; Versamid 115 Plus IRCO I.O.X. 1011	7
301-488-B	Dow Corning XR-6-0000; Versamid 115 Plus IRCO 9301	t <
301-488-C	Dow Corning XR-6-0000; Versamid 115 Plus Rosin Amine D	٠ <
301-491-A	Napko Corporation Zacrote #1360 Inorganic Coating	t u
301-491-с	Amercoat Corporation Dimetcote #4 Inorganic Coating	ט ר
301-491-E	Union Carbide Ucar R-101 Plus Primer and Topcoat	- ۱
301-491-F	Union Carbide Ucar R-104 Plus Primer and Topcoat	1 6

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	200	Less than 500	Less than 500
Rating	0	1	2	m	7	٧.

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

F. Bimetallic Corrosion Testing of Olive Drab and White Topcoats

Several of the vehicles mentioned in the preceding sections were incorporated into olive drab and white topcoats and evaluated for resistance to galvanic corrosion. In each case, the 301-275-E silicone-epoxy calcium chromate primer was used. Some of the coatings tested were the preferred materials developed earlier in the contract. Many of these coatings were baked to determine their optimum corrosion resistance. Bimetallic corrosion testing results may be found in Tables 96 and 97.

G. Bimetallic Salt Spray Testing of White Coating Systems
Since the Union Carbide UCAR R-101 and R-104 metal
treatments seemed to inhibit galvanic corrosion, some
riveted panels were prepared for salt spray testing.
Each coating system consisted of either UCAR R-101
or R-104, followed by 301-275-E silicone-epoxy:
polyamide primer, and topcoated with 301-368-F
silicone-polyester: polyurethane white topcoat.
Magnesium panels were coupled with steel or aluminum
panels. Two panels of each variation were prepared,
one being coated in the normal manner and the other
having the lapped area protected with a layer of
unreduced primer. The bimetallic salt spray corrosion
results may be found in Table 98.

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Table 96

Bimetallic Corrosion Testing of Olive Drab Topcoats

Coating Code	Pake	Coating Vehicle	Rating
301-112-B	ı	Dow Corning R-6-0031: 暑" RS Nitrocellulose	7
301-443-A	5 min. @400°F.	Pennsalt Kynar Dispersion	7
301-264-B 301-264-B	15 min. @350ºF.	1:1 Bakelite BRS-2600: Dow Corning R-6-0031 1:1 Bakelite BRS-2600: Dow Corning R-6-0031	9 9
301-270-C 301-270-C	_ 15 min. @350°F.	Midland R-55 Epoxy Ester Midland R-55 Epoxy Ester	
301-284-D 301-284-D 301-284-D	_ 4350°F. 30 min. @400°F.	Dow Corning R-6-0031: Mobay Mondur CB-75: Multron R-16 Dow Corning R-6-0031: Mobay Mondur CB-75: Multron R-16 Dow Corning R-6-0031: Mobay Mondur CB-75: Multron R-16	110
301-284-A	15 min. @350°F.	Dow Corning R-6-0031: Mobay Multron R-16	7
301-433-J 301-433-J	30 min. @400°F.	Dow Corning R-6-0031: Trancoa 560B Dow Corning R-6-0031: Trancoa 560B	
301-433-G 301-433-G		Dow Corning R-6-0031: Multron R-16: Mondur CB-75: Trancoa 560B Dow Corning R-6-0031: Multron R-16: Mondur CB-75: Trancoa 560B	 10
301-433-K 301-433-K	30 min. @400°F.	Dow Corning R-6-0031: Multron R-16: Trancoa 560B Dow Corning R-6-0031: Multron R-16: Trancoa 560B	
301-466-A	•	3:1 Bakelite BRS-2600: Dow Corning R-6-0031	7
301-467-D 301-467-F 301-484-B 301-485-A		Firestone Exon 461 3M Kel-F 800 301-284-D with lower pigmentation. 301-466-A with lower pigmentation.	4444

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corrosion.
Hours Exposed	200	200	200	200	Less than 500	Less than 500
Rating	0	1	2	m	4	\$

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

Table 97

Bimetallic Corrosion Testing of White Topcoats

Coating Code	Pigmentation	Coating Vehicle	Rating
301-182-B	TiO2: Talc	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	7
301-360-B	Ti02: Talc	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	7
301-368-F	TiO2: Silica	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	7
301-434-E	Ti02	Dow Corning XR-6-0000: Dow Corning XZ-2-2023	7
301-434-F	TiO2: Talc	Dow Coluins XR-6-0000: Dow Corning XZ-2-2023	2
301-498-A	Ti02	Pennsalt Kynar Solution	4
301-498-G	White Lead: Talc	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2
301-499-C	TiO2 Calcium Silicate	Do. Corning R-6-0031: Multron R-16: Mondur CB-75	7
301-499-D	TiO2 Barytes	Dow Corning R-6-0031: Multron R-16: Mondur CB-75	2

7

Bimetallic Corrosion Rating System

Condition of Panel	Perfect	Very few very small blisters or slight discoloration.	Many small and few medium blisters. Very slight corrosion.	Many small and medium blisters. Few large blisters and slight corrosion.	Many blisters and considerable corrosion.	Many blisters and severe corresion.
Hours Exposed	200	500	500	500	Less than 500	Less than 500
Rating	0	1	7	e,	4	\$

N.T. - Not tested due to cracking or other film failure.

G - Coating gelled during preparation.

\$

Table 98

Bimetallic Salt Spray Testing of White Coating Systems

Coating	Coupling		Lapped Area Protected	Results	Hours
UCAR 101	Magnesium: Steel	Steel	Yes	Slight correction on account of the state of	Tested
UCAR 101	Magnestim	A1	;		1200
		WTOTT W	Yes	Few small blisters on magnesium.	1200
UCAR 101	Magnesium: Steel	Steel	No	Severe blistering and corrosion of magnesium at lanned area	92.
UCAR 101	Magnesium: Aluminum	Aluminum	Se Se	Severe blistering and correction of management	1/0
				area.	170
UCAR 104	Magnesium: Steel	Steel	Yes	Few small blisters and slight corrosion of magnesium.	1300
UCAR 104	Magnesium: Aluminum	Aluminum	Yes	Few small blisters.	0027
UCAR 104	Magnesium: Steel	Steel	№	Severe blistering and corrosion of magnesium at langed and	0071
UCAR 104	Magnesium: Aluminum	Aluminum	N ₀	Severe blistering and corrosion of macmacium of larged	7/0
				eals added at meeting at the area.	170

NOTE: All the above coating systems displayed poor adhesion of the primer to the UCAR R-101 or R-104 at the conclusion of this test.

Section XIV

A. Summary

The following is a summary of results of work done on this contract:

- 1. 301-275-E silicone-epoxy copolymer primer is the preferred primer. 301-103-A silicone-epoxy ester primer is not as highly recommended because of three problems:
 - a. Adnesion of topcoats to this primer is far inferior to the adhesion of topcoats to the 301-275-E primer.
 - b. This primer is far more sensitive to lifting which may be caused by any strong solvents present in the topcoats.
 - c. The cure of this primer is quite variable which causes inconsistencies in recoatability, performance, etc.
- 2. The following olive drab topcoats, listed in order of preference, are the best that were developed:
 - a. 301-284-D silicone polyurethane
 - b. 301-270-C epoxy ester
 - c. 301-264-B silicone phenolic
 - d. 301-278-C silicone-epoxy copolymer
 - e. 301-278-E silicone-epoxy copolymer

- 3. Although no completely satisfactory white topcoat has been developed, the following are superior to others tested:
 - a. 301-360-F epoxy ester
 - b. 301-368-F silicone polyurethane

Formulas for all coatings are listed in the appendix.

4. It is believed that galvanic corrosion resistance is directly related to panel preparation. If coupled panels are properly protected around the lapped areas by the unthinned coating of primer, all the coating systems are satisfactory. If, however, no special precautions are taken, no coating will protect the magnesium from early failure.

B. Acknowledgement

The authors wish to acknowledge the invaluable suggestions and advice given to them throughout the contract by Dr. William D. Coder, Research Supervisor. They also wish to thank Mr. George K. Hughes, Section Head, Resin Research Laboratory, for the preparation of the experimental polymers used in this program.

Section XV

Appendix

A. Bibliography

Fitzgibbon, C.R., Miller, E.H., and Glaser,
 M.A., <u>High Temperature Protective Coatings</u>
 for <u>Magnesium</u>, Wright Air Development Center
 (1957).

B. Formulations of Preferred Coatings

All compositions are by weight and represent 100 gallons.

Primers

301-103-A Zinc Chromate Primer

Midland R-55 @50% NVM	450
Plaskon ST-847 @50% NVM	150
Imperial X-883 Zinc Chromate	163
Xylene	140
6% Cobalt Naphthenate	0.9
5% Calcium Naphthenate	1.5
4% Rare Earth Naphthenate	0.9
Exkin #1 (Nuodex)	1.3
Nilskin (Naftone)	1.3
	908.9

Weight per gallon - 9.09 pounds

Recommended thinners - Aromatic hydrocarbons

331-275-E Calcium Chromate Primer

Component A

Dow Corning XR-6-0000 @60% NVM	734
Mineral Pigments #1376 Calcium Chr	omate 314
National Lead Bentone 27	5
Toluene	12.5
Cellosolve	15
Methyl Isobutyl Ketone	12.5
	1093.0

Weight per gallon - 10.93 pounds

Component B

General Mills Versamid 115 @100% NVM	157
General Electric SR-82 @60% NVM	23
Toluene	177
Cellosolve	213
Methyl Isobutyl Ketone	<u>177</u>
	747

Weight per gallon - 7.47 pounds

Mix one volume component A with one volume component B

just prior to application.

Recommended thinner -	Toluene	125 parts by weight
	Cellosolve	150 parts by weight
	Methyl isobutyl ketone	125 parts by weight

Topcoats

301-284-D Silicone Polyuret:ane Olive Drab Topcoat

Component A	
Imperial X-1810 C.P. Chrome Yellow Medium	226
N.J. Zinc XX-50 Zinc Oxide	63
Mapico #516 Dark Red Iron Oxide	149
C.K. Williams Superjet Lampblack	53
#282 Clay	73
Johns Manville Celite #289	19
Davison Chemical Syloid 162	21
National Lead Bentone 27	5
Dow Corning R-6-0031 @50% NVM	487
Mobay Multron R-16 @100% NVM	56
Methyl Isobuty1 Ketone	130
Dow Corning Paint Additive #1	1.5
	1283.5
Weight per gallon - 12.84 pounds	
Component B	
Mobay Mondur CB-75 @75% NVM	243
Methyl Isobutyl Ketone	275
Cellosolve Acetate (Polyurethane Grade)	275
	793

Weight per gallon - 7.93 pounds

Equal volumes of Components A and B should be mixed just before using.

Recommended thinners - Methyl isobutyl ketone or a mixture of methyl isobutyl ketone and aromatic hydrocarbons.

If more flexibility is desired, the following catalyst system might be used:

Component C

Trancoa Chemical Tranco 560B @60% NVM	440
Mobay Mondur CB-75 @75% NVM	56
Methyl Isobutyl Ketone	176
Cellosolve Acetate (Polyurethane Grade)	176
	848

Weight per gallon - 8.48 pounds

Equal volumes of Components A and C should be mixed just prior to application.

Recommended thinners - Methyl isobutyl ketone or a blend of methyl isobutyl ketone and aromatic hydrocarbons.

Catalyzing component A with component C (rather than the usual catalyst, component B) will result in a more flexible coating, similar to 301-433-J (see section X.F. page 282)

301-270-C Epoxy Ester Olive Drab Topcoat

Imperial X-1810 C.P. Chrome Yellow Medium	120
N.J. Zinc XX-50 Zinc Oxide	35
Mapico #516 Dark Red Iron Oxide	62
C.K. Williams Superjet Lampblack	26
#282 Clay	39
Johns Manville Celite #209	11
National Lead Bentone 27	3
Midland R-55 @50% NVM	548
Xylene	158
6% Cobalt Naputnenate	0.7
5% Calcium Naphthenate	1.3
4% Rare Earth Naphthenate	0.7
Exkin #1 (Nuodex)	1.1
Nilskin (Naftone)	1.1
Dow Corning Paint Additive #1	1.0
	1007.9

Weight per gallon - 10.08 pounds

Recommended thinners - Aromatic hydrocarbons

301-264-B Silicone Phenolic Olive Drab Topcoat

Imperial X-1810 C.P. Chrome Yellow Medium	172
N.J. Zinc XX-50 Zinc Oxide	41
Mapico #516 Dark Red Iron Oxide	85
C.K. Williams Superjet Lampblack	33
#282 Clay	47
Johns Manville Celite #289	12
National Lead Bentone 27	5
Dow Corning R-6-0031 @50% NVM	318
Bakelite BRS-2600 @55% NVM	289
Dow Corning Paint Additive #1	1
Methyl Isobutyl Ketone	126
	1129

Weight per gallon - 11.29 pounds

Recommended thinner - methyl isobutyl ketone.

301-278-C Silicone Epoxy Olive Drab Topcoat

Component A

Imperial X-1810 C.P. Chrome Yellow Medium	224
Red Lead	119
N.J. Zinc XX-50 Zinc Oxide	64
Mapico #516 Dark Red Iron Oxide	88
C.K. Williams Superjet Lampblack	43
#282 Clay	74
Jouns Manville Celite #289	19.5
National Lead Bentone 27	3.5
Dow Corning XR-6-0000 @60% NVM	416
Toluene	81
Cellosolve	97
Methyl Isobutyl Ketone	81
	1310.0
Weignt per gallon - 13.10 pounds	
Component B	
General Mills Versamid 115 @100% NVM	83
Toluene	204
Cellosolve	245
Methyl Isobutyl Ketone	204
	736

Weight per gallon - 7.36 pounds

Mix equal volumes of components A and B just prior to application.

Recommended thinner -

Toluene	125 parts by weight
Cellosolve	150 parts by weight
Methyl isobutyl ketone	125 parts by weight

301-278-E Silicone Epoxy Olive Drab Topcoat

Component A

Imperial X-1810 C.P. Chrome Yellow Medium	222
Red Lead	118
N.J. Zinc XX-50 Zinc Oxide	64
Mapico #516 Dark Red Iron Oxide	87
C.K. Williams Superjet Lampblack	43
#282 Clay	73
Johns Manville Celite #289	19.5
National Lead Bentone 27	3.5
Midland X-4209 @62.5% NVM	412
Toluene	80
Cellosolve	96
Methyl Isobutyl Ketone	80
	1298.0
Weight per gallon - 12.98 pounds	
Component B	
General Mills Versamid 115 @100% NVM	86
Toluene	204
Cellosolve	245
Methyl Isobutyl Ketone	204
	739

Weight per gallon - 7.39 pounds

Mix equal volumes of components A and B just before application.

Recommended thinner -

Toluene	125 parts by weight
Cellosolve	150 parts by weight
Methyl isobutyl ketone	125 parts by weight

301-360-F Epoxy Ester White Topcost

DuPont Ti-Pure R-610	264
Davison Chemical Syloid 162	. 27
Midland R-55 @50% NVM	506
Methyl Isobutyl Ketone	206
6% Cobalt Naphthenate	0.3
5% Calcium Naphthenate	0.5
4% Rare Earth Naphthenate	0.3
Exkin #1 (Nuodex)	0.4
Nilskin (Naftone)	0.4
	1004.9

Weight per gallon - 10.05 pounds

Recommended thinners - Aromatic hydrocarbons

301-368-F Silicone Polyurethane White Topcoat

Component A

DuPont Ti-Pure R-610	261
Micronized Talc	142
Dow Corning R-6-0031 @50% NVM	725
Mobay Multron R-16 @100% NVM	35
	1163
Weight Per Gallon - 11.63 pounds Component B	
Mobay Mondur CB-75 @75% NVM	99
Methyl Isobutyl Ketone	334
Cellosolve Acetate (Polyurethane Grade)	334
	767

Weight per gallon - 7.67 pounds

Mix equal volumes of components A and B just prior to application.

Recommended thinners - Methyl isobutyl ketone or a mixture of methyl isobutyl ketone and aromatic hydrocarbons.